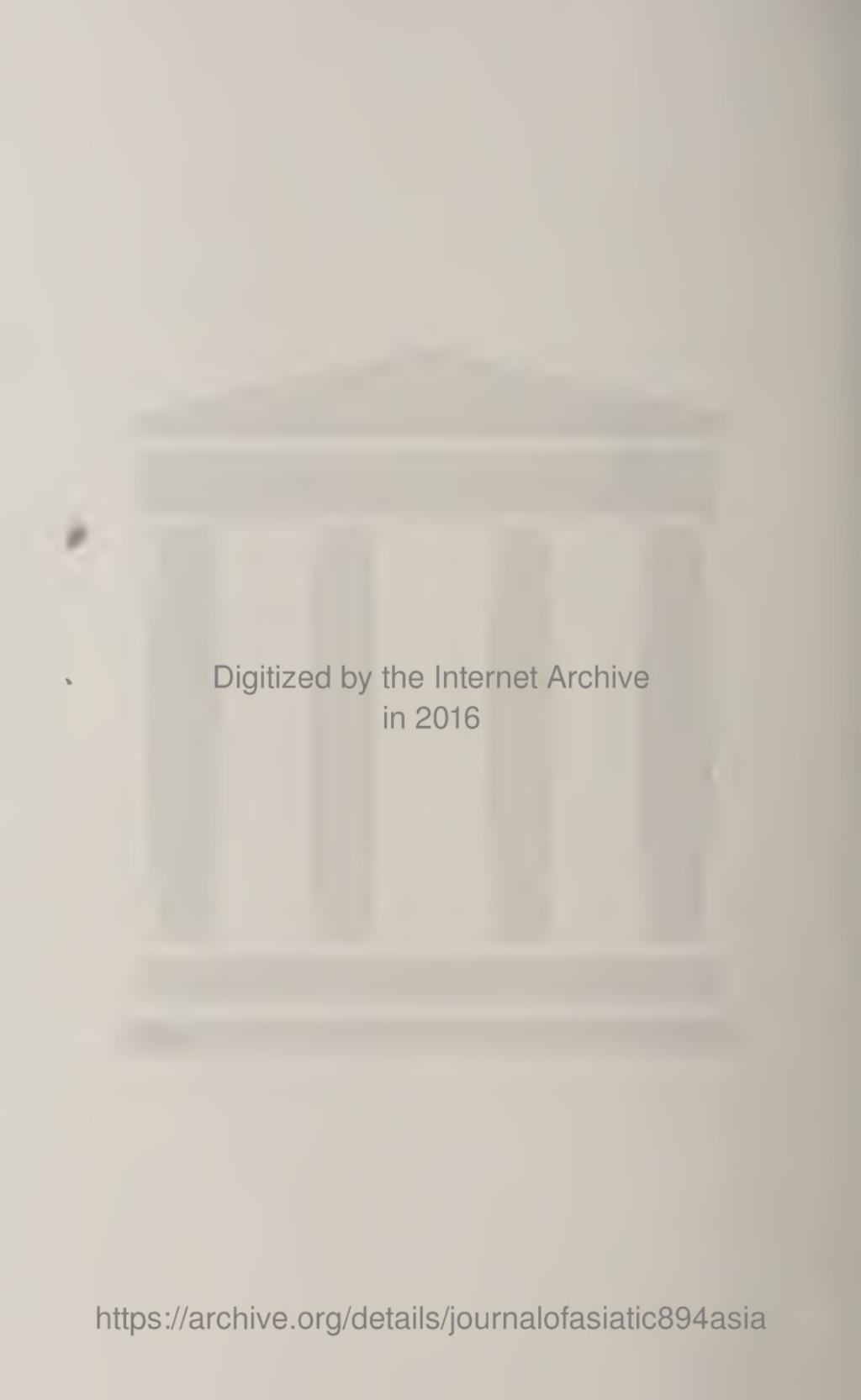


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ART. I.—*Memoir on the Climate, Soil, Produce, and Husbandry of Afghanistan and the Neighbouring Countries.—By Lieut. IRWIN.<sup>1</sup>*

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PART I.—OF CLIMATE.

SECTION I.—*Of Temperature.*

48. Even the most northerly parts of these countries lie in latitudes considered warm in Europe. But it is sufficiently known that latitude alone does not decide the temperature of countries. In the same parallel of latitude in the Russian empire the heat is less as the eastern longitude is greater. The causes of this difference seem yet unassigned, and until they be both assigned in a satisfactory manner, and shewn to be common to the southern parts of Europe and Asia in the same longitudes, there is but slight ground for concluding *a priori* the fact to be similar in them. The influence of altitude however on the temperature of place is undeniable, and exemplified in many familiar instances. Nor can it be denied, that the greater or less frequency and severity of rains must affect the heat of a place. Other causes might also be mentioned, for instance, the course of the winds. Distinct also from those which influence the annual heat of any place, there are causes which affect the equability of heat during the succession of the seasons. Maritime places have a temperature more uniform than inland. Even considerable inland lakes communicate a more equable temperature to their banks. The effects are the same of moisture in the soil. Countries whose surface is chiefly formed of sand or stones have more

<sup>1</sup> Continued from p. 776.

rigorous winters and more sultry summers than others in similar circumstances. The periods of the rains, the course of the winds, and perhaps some other circumstances, are to be weighed when a theory is to be given of the phenomena. I here content myself with detailing facts as far as known, with occasional reference to probable causes.

49. From Delhi to Peshawur, by the royal road which conducts through Lodhiana, Umrutsir, and Rohtak, the heat of the climate as estimated by that of all the seasons of the year, generally speaking, gradually diminishes. Even at Lodhiana, it is said, few nights are known in the season of greatest sultriness which have the oppressive heat of those sometimes experienced in our provinces. Whenever the road conducts near the great northern mountains, unusual coolness is experienced; but the neighbourhood of inferior hills seems in the summer at least to increase the heat. To this cause, and to the scantiness of the summer rains, we may attribute the sultriness of Peshawur in the midsummer. All the natives agreed in representing the summer of 1809, which was partly passed there by the Embassy, as unusually cool. Yet the heat by day, of the weather in May and part of June was considerable, and was on the increase when we left that place on the 12th of June. No relief is in ordinary years to be expected until the month of July, when either showers fall or the air is cooled by winds from the east, in which quarter the rains have commenced. Hence June may be concluded a warmer, or at least as warm a month as in Delhi. If the summer of 1809 be not supposed altogether singular, the nights in Peshawur are seldom disagreeably warm to those who avoid sleeping within the houses, and prefer the terraces. The summer too is of later commencement, and declines sooner than ours. The whole of the month of March may be excluded from it. The Hinduwee month Ussoo or Koonar, beginning on an average on the 13th September, is there called the first-born of the winter, an epithet it by no means deserves in our provinces, in which September is often warmer than August;—add to this, that the winter season is severer in Peshawur than here. Old persons remember a fall of snow, which, however, they acknowledge instantly melted. Frost is very frequently experienced in every season. On the whole then, it cannot be doubted that the annual heat is less in Peshawur than in any part of the Bengal provinces, except the skirts of the great northern hills. In this and many other cases we should be deceived were we to build conclusions on the proverbial expressions of the country, without inquiring by whom, and on a comparison with what, they are spoken. To the Afghans of the hills, Peshawur may seem

the seat of the most intolerable heat, because situated not far from temperate climates, and still the annual heat be under that of Delhi.

50. Bajour and Punjkora are considerably cooler in summer and colder in winter than Peshawur; a winter does not pass without a fall of snow, which is perhaps not melted in less than two days, sometimes a much longer space. Even in Koonar snow falls, though it soon melts except in the shade. Lughman is warmer in a small degree than Koonar, and Jellalabad than Lughman. These positions are to be understood of the plains only of these countries; the hills and mountains are cooler than they, and in a degree proportionate to their height. But during the summer there is generated the most excessive heat among the low hills of the Turnkzy tribe of the upper Milmunds, which from their bareness and dryness are commonly called the Beddoulut hills. Kohat is supposed to be a little cooler than Peshawur, and Malgeen is probably of a temperature the same as that of Kohat. Bunnoo and Eesa-Khel cannot be very different. The plains of Chhuchh-Huzara and Pukhlee are probably a little cooler than that part of the plain of Peshawur in which the city is situated. Moozufferabad is cooler than they, but is still to be pronounced a warm climate. Snow falls in Khanpoor of the Gukhurs. The more southern parts of this Doab are warmer.

51. The nether part of the Punjab, which includes Mooltan, is far warmer than the upper, and that for several reasons—a lower latitude, rains much more scanty, and the greater distance of cold mountains. The winter in Mooltan seems severer than in our provinces, and as in Bengal is accompanied with mists. The summer-heat, on the other hand, is probably greater. Mooltan, Seeweestan, and the Daman, are proverbial for heat. The nether Sindh is perhaps cooler, although situated more to the south, because it has more abundant rains. Its summer is certainly far cooler, being moderated by the neighbourhood of the sea; but, on the other hand, the same circumstance abates the cold of its winter. Notwithstanding its lowness, and probably moisture, the climate is much commended, especially in the southern parts. The country of Kuchh and the coasts of Bulochistan have a similar climate, neither hot in summer nor cold in winter. Kirachee is represented as unhealthy. The interior of Bulochistan is in general a hot country, but when the hills rise to a considerable height the climate becomes temperate. In Kilat snow lies on the ground during the greater part of winter; the summer however is warm. There are some inhabited places even colder than this in Bulochistan, on the whole however that country must be described as a warm one.

52. Cabul must be reckoned a temperate, perhaps a cold climate. In the three signs of the zodiac, Sagittarius, Capricornus, and Aquarius, the snow lies in the neighbourhood of the city. In Pisces it melts in the low and frequented places, but remains in the higher and less frequented. In this month are copious falls of rain, sleet, and snow. The first day of the ensuing sign of Aries is the vernal equinox, by the Persians and the people of these countries called Nouraz, because with it the natural year is considered as commencing. In Persia especially it is celebrated with much joy and festivity. In this month whatever remains of the snow melts in the plains. The summer which now succeeds is so temperate that the heat in the shade is never disagreeable, and no night is so warm as that a thick covering can be dispensed with. But the heat of the summer's day must be greater and steadier than in England, since rice and maize ripen in this district. The heat of the mid-day sun is indeed described as very great, and equally disagreeable as in the warm climate of Peshawur, where though the heat be unquestionably greater, its effects on the feelings and constitution are moderated by a more copious perspiration. The fact is to be accounted for, not by supposing the atmosphere of Cabul a moist one, for on the contrary the air of high places is usually dry, but by the difference of temperature. A temperature uniformly high, both in the sun and shade, in Peshawur keeps open the pores, which thus admit of a perspiration which relieves the body, but in Cabul they are kept shut by the coolness of the air in the shade. Cabul although warmer in the summer than England, is probably colder in winter. This we are to attribute to a situation more inland, and a skyless overcast; for it is certain that clouds moderate both heat and cold, as indicated by the thermometer. The climate is on the whole good, but is more commended by the opulent than the poor, of whom many leave the district in the winter for the warmer ones to the east, induced by the severity of the cold, the scarcity of fuel, and the difficulty of obtaining employment and wages in that season.

53. The valley of Cabul itself is diversified with inequalities of surface and varieties of exposure, and the neighbouring districts still more so. The temperature varies accordingly often within short distances, and it is impossible to give accounts more than generally true. The Kohdamun is colder than the immediate vicinity of Cabul, or the eastern part of the valley. The Kohistan and Ghorbund are colder than the Kohdamun. The summer heat of Ghorbund is said to be distressing to the Huzaras of the neighbouring hills. We have

seen that the Huzara mountains are not of the greatest height, but the cultivated and inhabited valleys being little beneath the level of the mountains are remarkable for their cold. In some of them the wheat harvest is scarcely completed in September. Some of those which open towards Bactria are warmer than Cabul, and the cotton plant is cultivated with advantage. In Cabul it may be and is raised, but the produce is little. Ghuznee and all the places situated on that high plain are noted for cold. That city is said to have been buried in snow nine days after the vernal equinox, yet I apprehend the real cold is not very different from that of Cabul, since the operations of agriculture and the harvest are but a few days later. To the feelings the cold of Ghuznee is made more sensible because of the want of shelter in the country. Mookr and Kura-Bagh are warmer than Cabul, and from Ghuznee to Candahar the temperature increases every stage.

54. Kushmeer is like Cabul a high valley, and in latitude somewhat more northerly. It is certain the winter is milder both in reality and to the feelings. The same periods are indeed assigned to it, and the snow lies during the same month, but it does not possess that cold felt in Cabul. The natives with no other protection to their feet than sandals of rice-straw travel in it without apprehension, and even in the depth of winter pass the heights which separate their valley from Kishtwar and its other dependencies to the south. Instances are rare of their losing their toes or fingers by the frost, but this is no uncommon occurrence to travellers in the countries of Cabul and Ghuznee. The wolf of Kushmeer has not that ferocity which he possesses in the severer winter of the last mentioned quarters. It is true the Vidusta is sometimes frozen over, whereas the river of Cabul after the junction of the Ghorbund stream never is; but a sufficient cause of this difference is seen in its greater rapidity. The summer of Kushmeer is probably of the same temperature as that of Cabul, but it is oftener cooled by showers. The complexion of the natives, which is usually a yellowish sallow, seems to indicate a climate on the whole warmer than Cabul. The Cabulies descended of families long established in their valley, are nearly as fair as Englishmen. To the feelings it is certain Cabul has the colder air, by reason of its breezy climate, while Kushmeer is a still climate.

55. It would be a tedious task (even were it possible) to particularize the temperatures of the various inhabited places among the mountains and hills already enumerated. They may often be conjectured to a considerable degree of accuracy by advertizing to some circumstan-

ces formerly detailed—the height of the hills, their character, whether steep or tame, and that of their valleys, whether deep and narrow, or the contrary. Slopes and plains even of moderately high hills have a cool and healthy air, but deep vales in the bosom of even the highest mountains have a hot summer, rendered still more disagreeable by stagnation of air, yet even they are warm only in comparison with their immediate neighbourhood. Of this class is the valley of Chitrun, so called from a town situated on the Kashkar river, and the capital of one of the four principalities of that country, (see paragraph 17.) The numerous valleys of Swad, Bhooner, and Pukhlee are warm, as is that of Khost, comprehended in the revenue division of Bunnoo, from which it lies in a westerly direction, in the bosom of the range of  $32\frac{1}{2}^{\circ}$ . The valley of Jajee is as cold as Cabul, that of Toree is warmer. Teera situated on the range of  $34^{\circ}$ , Oorgoon on that of  $32\frac{1}{2}^{\circ}$ , parts of upper Bungush, and the valleys in the Jadran range are somewhat warmer than Cabul. Zhob, in the Kakur country, is much warmer than Cabul, but much colder than Candahar. Even Pushing, or as the Afghans call it Psheen, the country of the Tureens, is somewhat cooler than Candahar; but Shorabuk, or the country of the Burches, is of the same temperature.

56. The country of the Dooranees considered as a whole, is of a temperature intermediate between Cabul and Peshawur, but exhibits considerable diversities within its own extent. Teeree, inhabited partly by Huzaras partly by Dooranees, is a cold place, falling not much short of the warmer parts of Cabul. The country called Zumeendawur, lying on the right of the Helbund in its further progress (see para. 41) is a temperate one. No winter there passes without snow, but to it succeeds the *gurm seer* (so called even in Tamerlane's time) in which there falls no snow. It lies WSW. of Candahar, which is only a little cooler. In some winters snow falls there, but it soon melts. The intensity of the summer heat is however moderated by western and northern breezes, and close nights are quite unknown. Few towns are more healthy than Candahar. Furah, although in a latitude somewhat higher, is warmer than Candahar; Subzwar, or Isfazar of the Zoorec tribe, is much cooler, by reason of its being situated on high land. Hirat is still cooler, and is probably not very different from Bokhara, to be afterwards mentioned. Still colder are the vallies of the Ymaks, which are yet far more temperate than those of the Huzaras, and generally speaking similar to Cabul. In Muro snow lies but a short time after falling. Toorshish is in a temperature perhaps the same as Hirat, and

Mushhud is considerably colder than both. Mushhud and Kilat of the Beéloches may be conjectured to have an animal heat not very different. Ghaeen and Birjund are various in different places, but generally may be pronounced intermediate between Hirat and Candahar. Seestan is warmer than the *gurm seer*, yet contains hills on which snow falls in the winter. The great desert to the south has a most sultry climate.

57. Snow falls every winter in the whole of Toorkistan, unless indeed there be any exception in the deserts towards the Caspian, of which our information is in most particulars very scanty. This country sloping westward, the eastern quarters are the coldest; but in the distance of a few miles there is frequently great differences of climate. It also deserves remark, that the kingdom of Bokhara and other parts west, being open countries, are also windy, and their air sharper to the feelings in the winter than that of the east. But no doubt exists of their real cold being less, for their winter is shorter, and the snow sooner melts. In Bokhara it seldom rains, but snows in the sign Sagittarius, which begins the 20th November. Snow falls knee deep in the course of the ensuing month Capricornus, and that quantity melts in five days. In some years there happens much greater falls, and it has been known to snow after the vernal equinox. The spring and autumn are generally temperate, and two months only of the summer are hot, namely Cancer, which begins the 20th of June, and Leo, but especially the former; the noon-day winds then feel warm, but close nights are not known. The natives are not so fair as the Cabulies. Khwaruzm is warmer than Bokhara; the kingdom of Kokur is colder, and has both a healthier and pleasanter climate, though Bokhara cannot be said to be unhealthy. Taskund is nearly similar. The Kinghuzes live in a colder country than the Kuzzaks, whose country is yet colder than Bokhara, and not much warmer than Taskund, which borders on it to the east. Keerategin is a cold country, but some places are much colder than others. The town of Durwaz is noted in its own neighbourhood for heat, being situated in a deep and narrow valley.

58. Budukhshan being composed of vallies which take their origin in mountains covered with perpetual snow, and whose months have nearly the same level as the lower parts of Toorkistan, thus possesses great diversity of climate. In many of the loftier parts the crops are in some seasons spoiled by the frosts before ripening. All the considerable places, however, lie in temperate climates. Fyzabad is warmer than Cabul. The Koocha is not known to freeze at that town or

below it. The river of Koonduz, in a far warmer country, freezes every year so as to admit of horses passing it, but its current is more sluggish. In Bactria there is considerable diversity of climate, arising from circumstances already mentioned (see para. 19.) The climate of Bulkh is perhaps the warmest; summer and winter succeed one another by a very rapid transition, and both are severe. These circumstances coupled with the moisture of the air, render the place neither healthy nor agreeable, and the natives of Cabul had the greatest aversion to serving in Bulkh when that place was in reality, as now it is in name, under their monarchy; many of its villages, however, are healthy. Koonduz though low, moist, and warm like Bulkh is yet more healthy. The districts to the south and east are colder in various degrees. The lower part of the valley of Khost is warm, and no place in Bactria is so cold as Cabul. Shibirghan, Undukho, Mymuna, and Kuburmach are healthy, and their temperature somewhat less than that of Bulkh.

59. Chinese Toorkistan although in general more northerly than independent Toorkistan, has not a colder climate, but rather the contrary, for the inhabited places are for the most part in low plains. Kashghur is colder than Yarkund. The temperature very gradually declines as we proceed to the more northern parts. The Pamer is exceedingly cold, yet may be crossed in autumn. With the exception of Chitkul, already mentioned (see paragraph 55.) Kashkar is undoubtedly a cold country, but to what degree we cannot yet tell. All the Tibets have rigorous climates, considerably colder than Cabul, even in the cultivated vallies. Between the Tibets and Hindooostan, the Punjab and other countries to the south and south-west, there is every degree of temperature, from mountains clad in never melting snow, to low and sultry plains.

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## SECTION II.—*Of Winds.*

60. In most countries it requires the observation of many years to determine what winds on the whole are predominant, and in what seasons of the year; we are otherwise in danger of stating local and temporary phenomena as general and constant. In the total want, in the present case, of such records, and under the necessity, moreover, of relying on the testimony or rather opinion of others, who may not have considered the subject with the patience it requires, it must be expected that the present account shall be meagre, perhaps in many points erroneous.

61. Some facts however seem to be established on sufficient evidence. It may be asserted that in the whole of Toorkistan, Budukhshan, and the north in general, the prevailing wind is from the north. In Bokhara it blows with considerable violence in the signs Cancer, Leo, and Virgo ; after three months cessation, it recommences, and blows, though with less vehemence, during Capricornus, Aquarius, and Pisces. These may with propriety be called midsummer and midwinter winds. The former are sometimes felt warm by day in Bokhara, the latter, when strong, are felt piercingly cold. Both vary from time to time in strength, blowing for seven to ten days with violence, and then remitting for nearly an equal time. In the wide space in which this northerly current prevails it may be supposed to have considerable variations in its direction, (for it need not be supposed to be always due north) strength, and other circumstances. It is not constant and strong in the west of Toorkistan, but it has occasionally given melancholy proofs of its power. It has submerged under sand the far greater part of the kingdom of Khwaruzm, and yearly curtails the habitable lands of Bokhara. The same civil consequences are not apprehended from the north winds in the quarter of Bulkh, yet even there they occasionally blow with great vehemence. In the war which Ty-moor Shah waged in that country with the Oozbuks, there were six successive days in which these winds suspended all hostile operations. Budukhshan, except in some particular situations, has a still climate, by reason of the shelter afforded by its lofty mountains, and is not so breezy as even Cabul ; the north winds however are there also the prevalent ones, though much diminished in their strength. It deserves remark, that the Persian word 'Shimal,' which properly means 'the north,' is in Toorkistan, Budukhshan, and the north in general familiarly understood by the signification of wind. In the Persian Gulph, the same denotes a blast. It is remarked in Bokhara that the south-east wind there, called 'Kypung,' is productive of great warmth, and when it occurs in the spring, the snow rapidly disappears.

62. If we pass from Toorkistan to Khoorasan we still find the same northern current to prevail in the western parts of that province—little change takes place in its direction, and even at Hirat it seems to be from nearly due north, but in longitudes more easterly its direct progress is opposed by the Paraparnisan mountains, which shelter that part of Khoorasan which lies to the south of them. At a moderate distance however from these mountains the current seems to recommence, though with diminished force and altered direction. It now inclines to the east of south, or even blows due east, as if to reach

the Afghan Khoorasan, it had been compelled to travel round the western end of the Paraparnisan range. In Candahar the direction of the midsummer winds is perhaps from the north-west, but at a considerable distance south from the Paraparnisan mountains the current resumes its force, and perhaps nearly returns to its former direction. In Seestan such is its force, that it has heaped up the sands of that country into waves; not a season passes but whole villages are buried under the sand, the inhabitants escaping with little beyond their lives, yet do they deem these winds a blessing. They moderate the heat, relieve them at times from the mosquitos, and they turn their windmills. At Kilat of the Beeloches the midsummer winds are from the north, for this place is situated too far to the south to be effected by the Paraparnisan mountains.

63. Hirat lies open to the north, and if we except Seestan there is no part of Khoorasan where these winds blow with such vehemence as in its neighbourhood. It has a windy season of 120 days, which returns with such certainty, that relying on it they here use no watermills, but windmills only. These periodical winds seem to commence earlier in Hirat than in Bokhara, and in Seestan earlier still. In that part of Khoorasan which lies west of Hirat the summer winds though of considerable strength and regularity, are not relied on for grinding the whole of the crops, on the contrary watermills are commoner than windmills; in former times the latter were more used than now, as is proved by the ruins to be seen in the districts of Cabul, Muro, Zumundawur, in certain parts of the table land of Ghuznee, and other quarters where watermills only are now employed. This change of practice may have arisen from a change of opinion, watermills having been found more eligible in all but the most windy climates, as being oftener at command than the others; or it may be considered as one proof of what all the natives assert, that the seasons and weather have altered from what they were in former times.

64. I know not how far southward we can trace these northern and north-western winds, but in the eastern longitudes at least they do not extend to the Ocean. The wind there on the contrary, blows from the south during the greater part of summer. We can trace this wind as far as Buhawulpoor, in latitude  $29^{\circ} 22'$ , and perhaps a good deal further. This southerly wind blowing from the ocean, communicates to the climate of the nether Sindhi an agreeable coolness. At Mooltan it shews itself rather in occasional blasts, than a constant current. By parity of reason these southerly winds may be supposed to extend a certain distance (varying in different longitudes with cir-

umstances) from the ocean into Bulochistan. But we have already seen (paragraph 62) that it does not reach Kilat, the latitude of which is not very different from that of Mooltan. In Jodhpoor it is said the west or north-west wind is the commonest in the spring and summer months, until the commencement of the periodical rains. In the upper Punjab also the winds are represented as being in the various seasons not very different from those of our Upper Provinces. In both countries clouds seem to assemble from easterly points (especially in the rainy season) and winds from westerly points shed their contents.

65. The winter of 1808-9 was spent by the Cabul Mission chiefly at Beekaneer, between that place and the entrance into the hills beyond the Indus. It was remarked as being singularly still ; and generally it may be asserted, that in all these countries the winter is calmer than the summer, the night also is usually calmer than the day. Travellers tell us that such is the cold of the Pamer in the autumn—the season in which it is most commonly passed—that did not the wind die away by night, this route would not be practicable. As before observed the mid winds of Toorkistau are not so strong as the midsummer, and in Khoorasan they are not always traceable. In Candahar, and some other situations, the month of October is more remarked as windy, than the depth of winter. The cold winds of that month, or rather of the sign Scorpio, which begins the 20th of October, strip the trees of their foliage. The same sign of the zodiac is windy in our Upper Provinces and in Peshawur, and in both cases it blows from a westerly point. In Cabul also this season is generally windy, as also in the sign Pisces.

66. Cabul however though at most seasons breezy, is in none remarkably windy, the north and west winds chiefly prevail. The same positions are, I presume, true of Ghuznee, which, however, has less shelter. Kushmeer has been already mentioned as possessing a still climate. The stagnation of air is sometimes very disagreeable, especially to those who have been accustomed to the free circulation in Khoorasan. Other places there are remarkable for continual wind, a circumstance owing to their situation between hills, which by confining the current of air accelerates it. Such is Jummoo, built not far from the left of the Chunab, and some other places of less note. Jellalabad and Koonur have never-ceasing winds, chiefly from the west. These threaten to bury under sand the good lands of the former. In Peshawur and Bajour the prevailing wind during the whole of the summer is said to be the east, and the observations made during the stay of

the embassy in that country correspond to this opinion. In the winter the chief winds in Jellalabad, Koonur, Bajour, and Peshawur, is the west, and next to it the north, which in Bajour is in that season productive of great cold. In Peshawur and Bajour, as in our provinces, are occasional blasts during the spring and summer months; in the former place they blow from the west and south-west.

67. Even in Bokhara hot winds are known, but they are confined to a few weeks in the year; and a few hours in the day, and altogether are little regarded. This is equally true of those in Hirat, but the hot winds of Seestan are severe. Those of Peshawur have been already mentioned (see paragraph 49.) Jellalabad, which on the whole has a cooler climate, has severer hot winds than Peshawur, because of its lying to the west, or leeward of the Bedoulut hills (see paragraph 50.) The wind from them is moderated in its bad qualities before it reaches the city of Jellalabad. Within the tract in which it is generated it is a true Simoom or pestilential wind, and many instances are given of its proving fatal to travellers. On the night of the 21st June, the Cabul Mission experienced a wind of the most intolerable heat; it blew from the low hills on which Attock is situated, then bearing south. The hottest winds appear to proceed from, or blow over, low hills, whose rocks and stones acquire a higher temperature than the soil of the plains. In the warm parts of Bulochistan, hot winds of very great severity blow. Instances are few of their proving fatal, but not unfrequently they scorch the shoulders and backs of travellers.

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### SECTION III.—*Of the Rains.*

68. In India from the northern mountains to Cape Comorin, the grand rains are those which beginning about midsummer, continue to the middle or end of autumn. The monsoon of the Coromandel Coast forms an exception, caused by peculiar circumstances. The rains, so called by way of eminence, on an average of seasons begin in Calcutta in the first week of June, in Futthigurh about the 20th of that month, and in the intermediate situations they are later, according as the place is situated more or less to the west of Calcutta. This rule is true in a majority of places and seasons. In our progress westward, it is also found that the rains are more scanty. The annual inches of water in Calcutta, are thrice those in Delhi. It is only in the lower parts of Bengal, that in the same season rains fall in the four successive Hinduwee months, Usarh, Sawun, Bhador, Koonar, of

which the first begins about the 13th of June ; far less can four months be counted in the Upper Provinces between the first and the last shower. Yet is 'Chowmasa' a term for the rains, in the whole of the Bengal provinces. The rains of the first and fourth month are more scanty and uncertain than of the second and third. The second again is more rainy than the third, and its rains more seldom fail ; it begins about the 13th of July. Places in the same longitude have more or less rain, according to their proximity to the great northern hills. This rule, however, does not extend to all places, for those which are near hills of considerable height within India itself, receive from that circumstance more copious rains. It is thus the province of Kuttack is more rainy than even the neighbourhood of Calcutta. Very many places in the Marhatta territories and the Dukhan are far more rainy than those in corresponding longitudes within our Upper Provinces. When other circumstances are equal, the number of inches of water which fall in the year diminishes in proportion as we recede from the sea. Hence Jodhpur and Oodeepoor have more rains than Beekaneer or Jypoor.

69. The rains of Hindooostan extend to certain points in these countries, and their periods and quantities are according to the laws just mentioned. The rains of Lahour are later, and less than those of Delhi. Those of Pothwar are still more so, and only the two middle months are relied on. One heavy shower in the month of September is of the utmost importance to their crops, but in some years is longed for in vain. In Peshawur only the second month of the rains remains ; nay, some seasons pass in which all are denied. The husbandman, however, sows in expectation of the rain of Sawun. From Peshawur we trace the rains to a termination in Lughman and Jellalabad, where they dwindle to a few showers. It thus appears that they diminish in our progress westward. But this rule is modified by others. Pukhlee, upper Sward, Punjkora, and Bajour, of which the two last are more west in longitude than Peshawur, have, as being hilly or near hills, much more rain than that place. Kushmeer lying to the east of all these has yet but a few showers, for the mountains to the south shut out the rains in this quarter, though we find by Captain Turner's account, that they have not this effect in the part of Tibet he visited. Barah-Moola, lying in the narrow pass leading to Kushmeer from the west, not only has a portion of the great rains, but showers in all the months in the year. Teera enjoys the four months of rain, but the showers are light. It is even said that it rains every day of the year in some part of the plains or the vallies of Teera. To the north the

great chain of mountains does not allow the rains to fall in Kashkuri, but the country of the Kafeis has an equal share with Bajour.

70. We have thus traced the summer rains in the high latitudes. In the middle latitudes they extend to all the sources of the river Koorm, being here diminished in duration to less than one month. These showers are generally severe, and important to the agriculture of the country. By the Afghans they are called, 'Vuse,' a term plainly of Indian origin. In latitudes still more southerly it is difficult to lay down the limits. The 'Vuse' certainly does not reach Candalier, but is sufficiently regular at Zhob of the Kakurs. It is said to reach Kilat of the Beeloches, but is not there the chief rain. Nay, it is by one person asserted to be known as far west as Punjgoor. This is rendered incredible by advertiring that that place is not very distant from the sea. Natives of Persia assure us that in most seasons there is a heavy fall of rain in the month of August in the province of Laristan; and I presume this is equally true of the coast of Kirman. It is probably the neighbourhood of the sea which gives to lower Sindh a rainy season of greater length than the upper, and perhaps not greatly inferior to that of the upper Punjab, yet has it been known in some years to fail, but the circumstance is of little importance to agriculture. Mooltan, distant at once from the sea and from the mountains, has very little remaining of the rains, less than any part, it is probable, of Sindh or Seewestan, or the Daman and Makalwad, though lying to the west. Buhwulpoor has more rain than Mooltan. The rains of Beekaneer are somewhat uncertain and scanty, for a country situated on this side the desert. Showers sometimes fall in Seestan during the summer, but they are unconnected with the rains of India.

71. In the Bengal provinces next in importance to the grand summer rains, are the showers which fall in the winter. By the natives this rain is called 'Muhawut,' because the greater part fall in the Hinduwhee month Magh, which on an average of seasons begins on the 13th of January. The farmers in what is called the Puharturee, or the tract of country lying at the foot of the great northern mountains, do not even water their rubbee crops, but trust to this rain, which however in some years fails, even there and in many parts of the plains more distant from the hills. The Muhawut extends from our provinces as far as Jodhpoor; but with respect to many parts of India I do not possess information as to whether it occurs or not. Part of the rainy monsoon of the Coromandel Coast coincides in time with it, but far exceeds it in quantity and importance. In the season 1808-9 it failed in our Upper Provinces in general, a circumstance productive of great

loss to the former. Neither did it occur in or near any place where the Mission was, that is between Beekaneer and Dera-Ismael Khan, but in those latter countries the want of it is productive of little or no inconvenience.

72. In the same season it fell abundantly in Peshawur, a province where a great proportion of the rubbee depends upon it; and all the countries now treated of, with the exception to be mentioned, enjoy it with tolerable regularity. It falls according to circumstances in the form of rain, sleet, or snow; and with respect to the time it may be expected, the chief showers are (as in England) rather in the second than the first half of winter. Although the time varies in different years, it is seldom that it fails altogether. The consequence of such a failure is dearth, sometimes famine. Where it used to fall as rain, the crops die from drought, or are killed by the severity of the frost that usually accompanies dry winters; where it used to fall as snow, the crops wanting this protection are exposed to the frost, and the hopes of the spring which partly rested on the melting of the snows in the hills are disappointed. There is a favorite proverb in Cabul, "let Cabul be filled with snow rather than gold." The quantity which falls is very various, according to season and places. The highest and most mountainous places appear to receive most, but this rule alone does not comprehend all cases. In Cabul the number of snowy days in the three months of winter is computed at sixteen. If we may form any judgment from the hints given us in Forster's Journal, this is more than occurs in Khoorasan. In the Punjab this rain is certainly of much inferior importance, perhaps it is of inferior amount, and less certain in its periodical return. But that quarter where it is most uncertain and most insignificant, is the same in which the summer rains are so scanty, and in which the Mission spent the depth of the winter 1808-9 (see paragraphs 70 and 71) being Mooltan, and a certain distance around it. In the Daman this rain is sufficiently regular, and of great importance. In neither Sindh, although of very little importance, it falls in most years. It may be observed that it extends far beyond the limits of the present field, to the Hellespont and the Russian frontier. The same is the chief rain in the north-west of Arabia. In none of the intermediate countries, whether cold or warm, is it lost. It is said to be but scanty in Yarkund, but with respect to many other parts of Chinese Toorkistan we possess little information on this, or most other particulars.

73. The third rain we may distinguish, is that of the spring. It is perhaps the most important of the whole in the countries lying west

of the Indoor, north of its sources ; in all of which it is confidently expected, and fails only in the most calamitous seasons or peculiar situations. In the neighbourhood of Candahar indeed, and the country of the Tureens, it is said to be but scanty, and little rain is looked for after the vernal equinox. The falls of snow and rain in the winter are in these places their chief dependance for the success of such crops as are not artificially watered. The spring falls are not confined to the countries under our view, but north and west, extend to the east coast of Arabia, a part at least of Syria, the Hellespont and Euxine, and the Russian frontiers ; towards India we find them tolerably regular in the middle and lower Sindh, but in the latter they are the less regarded, as they are of little use to agriculture, and in quantity inferior to those of the summer. In the upper Sindh and in Mooltan respectively, the summer and spring rains are perhaps equal. In the year 1809, some considerable spring showers fell in Mooltan, but in ordinary seasons this, like the preceding rains, is there but scanty and uncertain. In Peshawur, Kohat, Malgun, Fesakhel, and Bunnoo the spring is the chief rain of the year, the same is true of Chhuchh, Huzara, Kushmeer, and perhaps Bukhlee, but in Pothwar it is exceeded by the summer rain. We have seen that the latter diminishes as we proceed westwards. The spring rains, on the contrary, diminish as we proceed eastwards from Peshawur. This law however is modified by others ; and those of Kushmeer, as being a country embosomed in hills, are more abundant than those of Peshawur. It is difficult to fix the eastern limits of this rain. Within the great northern mountains, and to a certain distance from their foot, it seems to extend in ordinary seasons even to the banks of the Burmphoot, but in the plains of India nothing remains of it but some thunder-storms accompanied with showers.

74. Within the limits in which it is regular it is more or less copious, according to the season and place. Cabul receives more than Peshawur or most parts of Khoorasan, and Fyzabad more than Cabul. In Budukhshan, Durwaz, Keerategin, and the east of Toorkistan it is very abundant, but in Yarkund very scanty. In different places as well as in different seasons, there is some diversity in the season of this rain, but it would be tedious to enumerate instances. In general most rain falls in the month of March, but in some cases the heaviest showers are at the end of February or month of April ; rain in the month of May in most of these countries is not to be considered as part of the spring rains, but rather as accidental, and indeed unwelcome. In May 1806, there fell in Cabul a heavy rain which did much damage. Where

fruits are cultivated to a great extent. Rain in the summer is much deprecated, yet in some parts of Toorkistan showers are neither uncommon nor unwelcome even in the end of May. Generally speaking, May is a dry month in the countries under our view. June too is dry, and where the rains of Hindoostan extend, the hottest. The heat declines in August in both descriptions of countries. August is in Peshawur a cloudy month, not a rainy, and is dry in all the countries west of the Indus, as is September. October is a dry month both in India and in these countries. In high and mountainous situations snow begins to fall in November, but the chief showers are in December and January.

75. Dews and mists are often little less important to the husbandman than rains. They do not here attract much attention. They are commonest in the autumnal months, or the beginning of winter, and in the warm countries especially, if well watered and of a humid soil. Mooltan and Sindh to the south, and Peshawur to the north, seem the most noted for mists. The dews of Peshawur in August, September, and October, are said to be heavy. In September the people are induced from fear of the effects of the dews, as well as from the chilliness, to cease sleeping on the terraces. The spring there is more dewy than in Hindooostan. With respect to clouds and overcast weather, the cold countries have more than the warm. The atmosphere of Kushmeer is cloudy during a considerable part of the year; May and June are its most sunny months, but in July, when it begins to rain in the Punjab, the clouds extend to Kushmeer. In the cold countries in general, clouds are observed to gather from the beginning of October, preparatory to the snows, which are to follow.

76. On the whole the vast tract here surveyed must be pronounced to have a dry climate, whether we regard the quantity of moisture which falls in the year, or the number of rainy days. The districts which can be called humid are comparatively few and unimportant; the rains even of our Upper Provinces astonish the natives of Afghanistan. The spring rains are the chief in Peshawur, and the season 1809 was a favorable one, yet were there but seven days of heavy rain, and four of light. It would be difficult to form an accurate scale of the dryness and humidity of the various districts already enumerated, but a conjecture may be formed from the data already given. Khoorasan is on the whole drier than those parts of Afghanistan not included within it, or than Toorkistan. Bulochistan is undoubtedly a dry climate. The west of Toorkistan is far drier than

the east or south-east. Budukhshan, Durwaz, and Keerategin Buduk shan are more humid than Cabul, as is Kushmeer. The humidity Kushmeer adapts it for the production of rice, which however is the raised chiefly by artificial watering, and ripens in the drier part of the year. The dry and sunny summer of Cabul is favorable to the delicate fruits of the cold and temperate climates, which are here cultivated to a great extent and with much success, but in Kushmeer the apple only can be commended. Within the limits of India there is no place perhaps where less rain falls, and that little so irregular as the neighbourhood of Mooltan. This however is little regarded by the farmer, who waters his khuruf crop from wells or canals drawn from the river, and raises a proportion of his rubbee on the moist lands which in the cold season the river has abandoned. Nor does the scantiness of the rains imply a dry air. Mists have been already mentioned as common there in the winter.

77. Having now mentioned in succession the altitudes of the mountains and their course, the slope and conformation of the land, the sources of the rivers, the heat of the climates, and the periods and quantities of the rains and snow, we may proceed to deduce from these facts in combination the periods of the rising and falling of the streams and rivers. Few considerations are more important to the farmer and the traveller, or to armies.

78. In perfect plains in a warm climate we rarely find constant streams to originate. The rains of such countries though copious, are violent and of short duration. During the greater part of the year no moisture falls. The rains of the rainy season are drained off with a rapidity corresponding to their violence and their short duration. In their passage they cut deep channels which are dry during other parts of the year; such are very numerous in India, and are by us called dry nullahs. After rain they are always inconvenient to travellers, sometimes dangerous. Where they afford a level higher than the neighbouring ground under tillage, they are not without their use in agriculture, for by a little pains the water they discharge may be turned upon the fields. The Afghans are very sensible of their value, and reckon lands situated so as to be watered from them next to those which can be watered from constant streams, and superior to such as receive no water but what falls on their own surface. A dry nullah is in Pushtoo called 'Kherur,' and in the Hindhee of Peshawur and the west of the Punjab, 'Kus.' Even low hills in a warm climate usually give out but temporary streams. The snow which may fall on them soon melts, and the

springs which are found in them do not generally give out water. It is therefore plain that the periods of such streams as may originate in them must be the same as those of the rains and snows of the country; such are often of the greatest importance to the husbandry of a little neighbourhood, but their fame does not pass beyond those bounds. The Swan and Huro alone of this class are deserving of mention. They seem to have no periods distinct from the rains in the country, but their springs are sufficient to preserve them running streams at all seasons until they gain the Indus, whereas most others lose themselves, or are expended on the fields, in all seasons but the rainy, and some do not in any season reach the sea or a river.

79. We every day hear of mountains so lofty as to be covered with never melting snow. The expression construed in strictness would lead to an erroneous conclusion, for, that ice or snow can only remain unmelted which lies in a place whose temperature is never above the freezing point, and few such can be found within the habitable climates. Snow gradually disappears even during a hard frost. Part it is true, is carried off by evaporation, but part also is melted by the heat of the earth. The rivers of Switzerland rise from under glaciers of solid ice. As the inferior snows are gradually melted away, part of the upper also deprived of this support, either gradually slide down the declivities, or fall in avalanches, themselves to be melted in lower and warmer regions. The snow and ice are therefore perennial only because they are supplied from time to time as fast as they are consumed. It is also evident from the same principles, that the fall of snow in winter must in all cases have some tendency to augment the streams, since part is forthwith melted by the heat of the earth. But where these streams originate in hills of considerable altitudes, a far greater part is as it were stored up for a warmer season, and according to the degree of that altitude, and the cold consequent upon it, the season of its melting is later or earlier. While the snows of the low hills are rapidly melting by the warmth and the rains of March, it is at the same time snowing on the high mountains, whose previous stores are as yet unaffected by the weather. The increasing heat at length dissolves them in the order of their altitude, the highest of all melting at midsummer. It is therefore evident that as far as depends on the melting of the snow, streams rising in low hills must be highest in the spring, and streams rising in high hills in the summer; and the periods of the streams would thus be an index of the altitude of their sources. But when a river is fed by the snows of both high and low hills, we

cannot thus decide without adverting to other circumstances. If the low hills be extensive, the flood they occasion may surpass that arising from the melting of the high snows, under which are situated the uppermost sources of the river. If the river be highest in summer, we may decide that it has lofty mountains at its head. This conclusion however is just only when we put out of view the periods of the rains, and decide from those of the thaws only. Both considerations must be combined in our judgment in particular instances, to which we now proceed.

80. The periods of the Indus and the rivers of the Punjab are nearly the same as those of the Ganges and its tributary branches, which are lowest in the winter, rise somewhat in the spring, and are highest in the middle of August. The rise in the great Ganges is perhaps gradual, certain, and nearly of the same quantity in different years; for being fed by many streams one chance and anomaly corrects another, but the same is not true of its branches, including the upper Ganges itself. The annual rise at Hurdwar is six or seven feet; in the lower part of Bengal above the influence of the tide, it is thirty-one. This difference, may I believe, be shewn to be a consequence from the general principles of hydrostatics; it must therefore be supposed to exist in the case of the Indus and its branches, for they also run in a champaign country and yielding soil. My inquiries tend to confirm this opinion. After rains of uncommon severity the rivers of the Punjab sometimes rise to a great height; the effect however is temporary, and many seasons pass in which no such extraordinary floods occur. The great Indus after the junction of the Punjnad is from various causes less affected by local and temporary circumstances, but its regular and annual rise is greater than that of any of its branches. The branches have diversities among themselves not reducible under one general rule, but caused by special circumstances. The Ranee, which is the least of all the rivers, had yet in 1809 a rise equal to any of them. When other circumstances are the same, streams which run in sand increase more in breadth in their flood season, and those which run in clay increase more in depth. The annual rise of the great Indus I reckon about sixteen feet; that of the Ganges is thirty-one; and of the Nile twenty-four. The proportion in which their waters are respectively increased it would be more difficult to estimate. The same causes combine in the raising the Indus and its branches, and the rivers of our provinces—that it both thaws and rains. The effects in this respect are different, in that there is no inundation in the Punjab or Sindh, for we cannot apply that term where the tracts covered

are insignificant in proportion to the whole surface. The character of the Punjab is different from that of Bengal or Egypt. Instead of the banks of the river being higher than the remoter country, the various Doabs usually slope from their interior towards the rivers which bound them. Low tracts are sometimes found, which after heavy rains are covered to some depth with water; but there is no general inundation derived either from rain or from rivers, as in Bengal. The surface of the Punjab, however, after excluding the country beyond the Hydaspes, is lower above the level of its rivers than that of our Upper Provinces in general, with respect to the rivers which run in them.

81. The periods of the Cabul river where it joins the Indus are nearly the same as those of it. It is lowest in the winter, notwithstanding the rains of that season in the valley of Peshawur. It is sensibly affected by the spring rains in February and March. It falls after they have passed over, yet not to its level in the winter, for now the snow of the lesser hills begins to thaw. At the end of May the middle snows begin to descend, and after them the upper, which bring the river to its greatest height at the beginning of August. We are to attribute the effect in part to the rains, which fall at that period at some of its sources (see paragraph 69.) Such is the history of the grand streams, but there is a diversity of circumstances with respect to the branches composing it. The Pech river swells early in spring, and declines from about the 28th of May. The Punjkora river follows nearly the same laws, though indeed heavy rain in the months of July or August will cause it to reach its greatest height in those months. The three streams in the valley of Cabul (see paragraph 36), the Lughman river, the Kashkar, and the Swad, with the rivulets of Jellalabad are highest in the month of July or August. The Bara is on the whole the greatest in the spring, but it rises and falls very suddenly, and very often according to the occurrence or cessation of rain in Teera. The To is probably greatest in spring; the Koorm is greatest in July or August, when it is swelled both by the *Vuse* (see paragraph 70) and by the thawing of the upper snows. The Gomul is perhaps the highest at the same time.

82. The diminutive streams of Bulochistan and Seeweestan are in general highest in the spring. The same is true of those found in the western Khoorasan, the Turmuk, and the little streams of the Kakna, Tureen, and Burch countries. Even those rivers which taking their rise in the Paraparnisan flow into Khoorasan, reach their greatest height during the periodical spring rains. The Helbund only which

rises in the most elevated part of that ridge continues to increase after that period. It perhaps reaches its acme the first week of June, but I have received contradictory information on the subject. The Murghab, and whatever streams are found in the Jumsheedee country, in Mymuna, and Undkho, may be presumed to be highest in the spring.

83. The Oxus and Jaxartes, and all their remaining branches which have been enumerated in the introduction, including the streams of Bulkhi, rise in the spring, but are highest in the summer, notwithstanding the draught of that season. Some of the subordinate streams are higher in spring than in summer, but they are considerable enough to impart the same character to the principal ones into which they discharge themselves. With respect to the Neelum, and the rivers of Chinese Toorkistan, we know little beyond their names. From circumstances it may be conjectured that they are higher in summer than in spring.

#### SECTION IV.—*Of Salubrity.*

84. I am able to offer but a few detached observations on this subject. Its importance induces me not to pass it altogether in silence, although my opportunities have been small, and its natural difficulties are very great. There are few subjects on which opinions are so contradictory, and so many regular prejudices prevail. Medicine is at a low ebb in the country, and its professors entertain many absurd opinions respecting the original causes of disease, most of which they deduce from the qualities they attribute to different species of food, paying little regard to the operation of other causes, which among us are considered as the most palpable and powerful. The doctrines of Avicena are much followed, especially in Toorkistan. Physicians in these countries are not liberally rewarded, and many are obliged to travel from place to place in pursuit of a livelihood. These are chiefly natives of Peshawur and its neighbourhood, and their travels are principally confined to Toorkistan, which they visit on the opening of the spring. Few or no natives of Toorkistan or Khoorasan pass into other countries with such views. Some of these itinerants add the practice of the *ruml*, and other occult arts, to their accomplishments. They traverse great spaces, and being everywhere welcome, have the best

means of observing the manners of the people, as well as the nature of the country. Accordingly there are found among them many who are stored with curious and useful information. In their own profession they seem to be judicious, according as they have more or less discarded the absurd theories of their books, and proceeded on their own observations, and the practical remarks current in the quarters they have visited. Although surgery be on the whole in a low state, there are some operations which are here performed with great judgment. There are parts of the country in which continual strife prevails, and wounds are generally received, and yet scarcely one professed surgeon is to be found.

85. The Cabul Mission left Delhi on the 12th of October, 1808, and arrived at Beekaneer on the 5th of November. During its stay there many natives of the escort and camp followers were buried. This was not attributable to the unhealthiness of the place or season, but to some preceding circumstances,—severe marching in sand, bad or indifferent water on the route, and great vicissitudes of heat and cold between day and night in the month of October; but, above all, the incautiously eating water-melons and drinking water after heat and fatigue. In passing the desert some individuals were affected with *Nyktolopia*, but by proper treatment they speedily recovered. Diseases in Buhawulpoor, Mooltan, and Dera, and Ismaul-Khan are generally the same as those of our provinces, with the addition of eye complaints, which are comparatively rare in them. Coughs and catarrhs are common in Buhawulpoor. The natives of the detachment experienced during their stay in this country, a cold somewhat greater than that of their own. In the march to Peshawur they were exposed to severe rain, cold, and fatigue, combined. In Peshawur they were but ill accommodated, and exposed to heat and closeness, yet during all this time they were never unhealthy. They marched through the Punjab during the rains, a circumstance which far from being unfavorable, probably preserved them in greater health than they would have enjoyed if halted; there is therefore no reason to conclude the countries they passed through to be unhealthy for strangers.

86. The water of the upper Punjab indeed, is celebrated both by natives and strangers, and the climate vaunted as remarkably salubrious. This boast is not altogether unjust, for here we find but little of the eye complaints so common in similar climates to the west and south. The Sikhs seem a healthy race, and there are found among them some fine persons and faces. They appear built, however, more for activity

than strength. They do not accustom themselves to foot service, and probably could not undergo great fatigue except on horseback. This is still more true of the natives of Toorkistan. Such is the plenty of horses in that country, and so much are they reckoned a necessary of life, that even beggars travel on horseback. The natives of Khoora-san have a great aversion to foot service, and do not excel in that species of travelling, in which the natives of India are generally acknowledged to surpass all their western neighbours. This is absurdly attributed to their foot, when it can be more naturally deduced from the state of their country and their mode of life. Among them none are equal to the Bhutties, or people of Bhutner, where there are said to be some who will travel 30 kos, and after robbing a village or a caravan return the same distance without halting. The people of Hurreeana are in this respect somewhat inferior, but are a robust nation, and in bravery surpass all their neighbours. Being now under our Government, it behoves us to consider how we shall make use of these qualities, or at least prevent them from being turned against us by an enemy. The hill tribes among the Afghans, and others, excel in climbing and in travelling among mountains. The Khyburees are employed in hill warfare as far east as Kot-Kangra, which is situated near the right bank of the Hyphasis before it leaves the mountains; but the Kohistanees are reckoned to excel all others in such operations, and have been known to fight well even in the plain. It is a common observation in the country, that the inhabitants of hills make little figure in war when they venture into the plains, and during the late broils more than one instance has occurred to confirm it. None is more striking than the defeat of Shooja-ool-Mook, when in the spring of 1802 he brought a force of Khyburees against Peshawur. It is said their inability to bear the heat of the climate was the chief cause of their discomfiture, which terminated in many of them dying of thirst. The natives of the cold and temperate climates express the utmost dislike to the summer heat of that of the warm, but their impatience under it is not always in proportion to the coldness of their native places. The Cabulies support it better than the hill Afghans, or even the Dooranees, whose climate is much warmer than Cabul. This part of the Dooranee character has been very manifest in their history, and productive of important effects. The Persians, though inferior in courage, excel them in steadiness, another good quality of a soldier, and bear the extremities of heat and cold with equal patience. The poverty, ingenuity, and enterprising disposition of the Kushmeerees annually disperse considerable numbers of that nation

over the greatest variety of climates ; and in pursuit of gain, they seem little to regard the heat or cold to be endured.

87. The natives of the warm climates do not manifest the same impatience of the winter cold climates ; on the contrary, Cabul and Kushmeer are the theme of their praises. It seems doubtful whether this quality of the warm climates, by which those born in them are adapted to both species of climates, can be brought forward more in their commendation, or as an argument of their being plainly inferior to the others. It will be found generally true, that in cold climates there are more numerous diseases, perhaps more unhealthiness ; but the natives are more robust and enjoy longer life. In these countries it is remarked that the hair sooner turns grey, and life is shorter in the warmer districts ; eye complaints, moreover, are most common in them. When known in the cold, they usually proceed from travellers having exposed themselves to the glare of the snows ; but the summer is the season of this complaint in the warm districts. Even those patients in whom they have become chronic, feel a remission of their pains in winter. The natives have no rational theory to account why they are more prevalent in some warm countries than in others. Because they affect moist districts rather than dry, these theorists maintain them to arise from the eating of rice, not adverting that they are not peculiarly severe in Kushmeer, and that there are places in which, though rice be the chief food, they are rarely known. It is a singular fact that ophthalmia begins to be common where the summer rains of India become scanty and uncertain. I am inclined to be of opinion with Volney, that it is caused by the dews and breezes to which those who sleep on the terraces expose themselves.

88. Fever is an universal complaint. Fevers are most common at the equinoxes, but those of the spring are generally of the hot species, where agues and low fevers prevail in the autumn—which, on the whole, is the unhealthiest season of the year. The former species of fevers are commoner in the cold than in the warm districts, and the reverse is true of the latter. The effusion of cold water in the paroxysms of hot fevers, though practised in Persia for ages, is here unknown, except to the Kafirs. It is a general practice to take purging medicines and to draw blood in the spring. Under another subject (see para. 51 and 58) a few places have been mentioned as unhealthy ; there now remain very few to be added. There are many diseases in Kushmeer, a fact less owing to an unhealthy air than to filthiness, poverty, and the degraded condition of the inhabitants. The Kashmeeres are at the same time

a robust race, and excelled by none in carrying burdens over mountains. The Huzaras and Oozbueks, especially the former, are broad in their persons, and strong. The water drawn in the interior of Cabul disagrees with strangers, and there is a good deal of sickness among the poor by reason of their being ill accommodated, and the town too closely built, otherwise the climate is not unhealthy, and Peshawur is not inferior to it. Serofula, a complaint little known in India, is not uncommon among the Daoodzyes, and some other tribes.

89. Khoorasan is undoubtedly a healthy country; and in Toorkistan we can name only a few situations which deserve to be called unhealthy. The most remarkable is Bulkhi, which is afflicted with eye-complaints, all species of fevers, consumptions, the Guinea-worm, dropsy, and many other diseases; yet some of its villages have a good air. The most remarkable complaint of Bokhara is the Guinea-worm, which appears in some other situations in the east of Toorkistan and Baetria, in some villages of Candahar, in certain parts of Huzara and of the Pahar-turee of our provinces (see paragraph 71), in Hureeana Haroutee, and many other quarters of India. In all cases it is commonly ascribed to the quality of the water. In Toorkistan the inhabitants of those cities in which it is most prevalent drink from tanks, the water of which is only occasionally renewed. Where running water is to be had the disease disappears; yet I have heard it pretended that there is something in the air of Bokhara which occasions it, and a pleasing story is told of a certain Moolla who was sceptical in this particular. Being persuaded the water only was to blame, he resolved to use none but that of water-melons, and confidently expected to escape; but before he had passed a year in Bokhara he had a number of worms extracted from his body. The only other local complaints deserving of mention is the Goitre, which is now supposed to be the consequence of drinking water impregnated with certain minerals; it is not unknown in Baetria, but its chief seats are the banks of the Kishun Gunga, Sirn, and Peeh. The waters of the Uba Seen have somewhat of the same bad quality, and Goitres are common in certain parts of the Gukhur and Khatir countries. It is asserted, that on the banks of the Peeli even the dogs and tame birds are affected.

(*To be continued.*)

ART. II.—*March between Mhow and Saugor, 1838.*

Many of the places visited in this journey, were unavoidably visited (it may be almost said) at a gallop; the descriptions are not therefore offered as minute and faultless details, but rather as sketches claiming every indulgence; whose aim is to stimulate the curiosity of future travellers over the same ground, who may have more leisure to pursue the inquiry. Some apology seems also necessary for the digressive nature of the notes. Their best excuse will be their proving either interesting or instructive. Nothing was observed worth noticing till the fourth march,—unless we except a warm spring\* between Duttoda and Oouchade, known by the name of the “Kiaura Koond” from a few of the so-called trees, whose flowers perfume its banks, and which give a title to a Ling temple near it, “Kioureswar.”

Some time after leaving Akberpoor, the road crosses a range of low wooded hills, issuing from which the small village of Kurnawud is seen, half-hidden in foliage on the right. It boasts itself to derive its name and origin from one who plays a conspicuous part in the “Bharut,” the ear-born son of Kunti—the 6th Pandoo—the gallant and generous Kurun. Not content with the wonderful adventures of which he is the hero in “the great war,” the inhabitants of the vicinity possess a goodly store of silly local *cheritras* regarding him, which they eagerly recite, and believe with perhaps a more lively faith, than will elicit from them the more orthodox, but less familiar, fables of Vyasu. One of the legends they told us, was that which is found in Conolly’s overland journey,† and the others were of a like stamp. A Ling temple close to the village, honored by the name of the hero, appears—the lower part of it at least—to be of considerable antiquity; though a plastered roof now covers the Subha, and a modern brick dome supplies the place of the doubtless once pyramidal Sikra; the

\* Springs of this kind are not uncommon in the offsets of the Vindhya. They rarely are of higher temperature than 80°, and have no remarkable chemical properties.

† Vol. ii. page 286. The story is however not in the Bhagawut. It may possibly be found in the “Kurun Upakian.” A Basfa poem, the “Gurb Chintamani” describing the inconstancy of human glory, thus speaks of Kurun’s charity, and his end, in popular doggrel—

Raja Kurun bihoto	Death has seized as his prey
Kunchun khatma deto	Kurun, who lavished gold;
He nur muryga chun me	Like a spark he passed away;
Dera kuryya bun me.	His grave is in the world.

fragments of which lie scattered around. Among the ruins may be observed a mutilated horse and rider, which perhaps represented Raja Kurun and his steed ; a large female bust with three faces ; and a head, the size of life, (we searched and inquired in vain for the trunk), having the thick lips and curly looking hair of a Budhist or Jain saint. The latter we incline to believe, since the Jain faith, as will be presently seen, was formerly very prevalent in this neighbourhood, and no traces of Budhism were observed ; unless the *trimukhi* be assigned to that sect,—as are by some,\* the celebrated *trimurtis* of Elephanta, &c. An Indian Budh too, may generally, (perhaps not invariably,) be distinguished† from that of a *Tirthaukur* by its more elaborate ornaments.‡ There is usually on the crown of the first, a knot which resembles hair collected into a knob ; but this knot is often changed into an ornament, evidently attached to a cap,§ probably in some cases made of hair ; and which, fitted tight to the skull, covering the bald shaven head, with which Budh priests are so often twitted by Hindoo dramatists.|| Thus in the “Prabodha Chandum Udaya” (see Wilson’s Theatre) Soma Siddhanta calls the Budh, “ thou uncombed one.” The Budh head-dress is indeed most changeable ; but the Jain twenty-four are almost invariably imaged, wearing only the non-increasing locks which forms one of their *atisyas* :¶ these, they are

\* Quar. Oriental Journ. No. 14, page 219. Several female *trimurtis* are figured in Raffles’ Java.

† There is seldom any difficulty in deciding whether a perfect image is Jain or Budh, though some of the tests recommended are of questionable value. Wilson says, As. Rs. 16; 457, “ It is more common to find Jain pontiffs shaded by the snake.” Now, though many Budhs, (T.R.A.S. 3; 481—As. Rs. 16; 458 plate—Crawford’s Siam, 109—Davy’s Ceylon, 468, &c.) and inferior Jain deities, are thus sheltered—Parusnath alone of the Tirthaukurs is shaded by the Nag ; and even he is sometimes represented without the hood,—the snake being merely carved at his feet, as the *San-chun*, or distinguishing mark. Perhaps one of the best tests is the “ Sri Butch,” which (here at least) is carved on the breast (butchus, the chest) of every Jain image. We have never remarked this symbol so placed on a Budh statue.

‡ Prinsep says the contrary (J.A.S. 5; 485), but the Budh head-dress is not certainly “ simple.”

§ See the drawings of the Dhyani Budhs, Bombay Trans. vol. 2; or As. Rs. vol. 16.

|| The shaving of the head among the Hindoos was infamy, As. Rs. 17; 616. That Budh was shaved, we may judge from the curious pantomime practised in Ceylon, Davy 125. Among the living representatives of the saint there would appear to be no fixed rule, as in Du Halde, vol. 2, one Sama is described as having the head shaved, another with curly locks.

¶ A.R. 17; 217, In the only list of *atisyas* at hand, that in the Sri Pal Cheritra, the curling of the locks is not included. Wilson’s authority was probably different

often described in their Shastrus as pulling out by handfuls : and some Jain pundits have even assured me, that what appears like hair on their statues, is not intended to represent hair, but the naked scalp thus forcibly deprived of it.\* Jain saints, however, like the Budhis, sometimes wear a *mookhut*.

On a pilaster to the right, as you enter the temple, is a rudely cut inscription, from which it is to be feared but little light will be thrown on the history of the place ; as it merely records, and that indistinctly, the grant during the reign of the liberal and wise Deva Pal, of ground for twenty temples to one Yusheek Pal. The date, A. D. 1158, is a dark period in Malwa history : and Deva Pal, whose name is not to be found in the list of kings, was probably some petty chief, who in those days of anarchy and confusion, raised himself to temporary consequence in this wild part of the country.

Peeplia, three miles from Kurnawud, contains no antiquities, and but one place worth visiting—a Digumbir Jain temple ; which as the place is under the tolerant rule of a Rajpoot, (the Raja of Baglee), occupies a conspicuous position in the Bazar, instead of being concealed, as in a Mahratta town, in some obscure alley. It may be here noticed that from this to Saugor, the Jains are chiefly Digumbir, consisting, for the most part, of Pudmavati Pwawurs ; which Ginat† is entirely of that class. Switumbirs, as elsewhere remarked, are more commonly met with round Ougein.‡

From Peeplia a road strikes off to Hoshungabad, and the report of antiquities at the first march induced us to deviate so far. We found

\* Modern Jain priests, as far as I can learn, have no fixed rule of wearing their hair. They generally shave it in front, and allow it to grow long behind. But Dhoondias, Soomegis, and a few Gooroos and Jutties eradicate the hair, though not in the Panch Mooshti fashion of their ancestors, only plucking them out occasionally, as for instance once a year, tenderly, and one by one. Budh priests have, if I mistake not, in all countries always shaved their heads, Davy 296, 210, 219. Carous, Japan, Crawford, Mandeus, M. Polo 253 and note. When a Jutti adopts *achela* he shaves all the hair off the child's head, except one lock, which it is the Gooroo's part to pull out (*lachun.*) The Digumbir sannyasis of the south never shave A. R. 9. 284.

† गीनात् So vulgarly spelt and pronounced. Miles writes the word *Nat* : Tod, *Nyat* : Sanscrit न्यात्.

‡ That is taking Ougein as a centre, and giving the circle a radius of forty miles : but north of Ougein, Visnooi Buniabs outnumber the Jains. From Rutlam the Digumbirs begin to increase ; and from Banswarra to the Aravulli, hardly any other tribe is to be met with but Digumbir Hoomurs. Guzerat, Marwar, and north Mewar are the chief seats of the Switumbirs.

however, only some Jain statues, eight or ten feet high, a few lying in the miserable village ; the best on the top of a hill, which overhangs it. The temples which once sheltered them, of which there were the ruins of three or four on the hill, have long been thrown down ; but we could calculate their age with sufficient precision ; for, though the weather-worn inscriptions on the plinths of the statues were illegible, the date 11th or perhaps 12th could be traced. We made out but one *Sanchun*, the deer of Santinath.\*

Whether these images are Digumbir or Switumbir, it is impossible to say, for all statues of the twenty-four are Digumbir, or at least naked. Some Switumbirs indeed pretend that *their* statues may be detected by a string (Kundora) round the loins—a doubtful proof, since the wrinkles of the belly are very likely to be mistaken for it. All,† whether Digumbir, or Switumbir, have as before remarked, the *Sri butch*,‡ with which mark the future Tirthakur is said to be distinguished at his birth. In fact there is not any positive distinction between the undressed images, as is proved by some of them—the celebrated Rikhabnath near Doongerpoor for instance—being claimed by both sects. Tod's remark (Raj. 2 ; 744) which seems to argue the contrary, may be safely taken as a flourish.

Though the antiquities of Bijwar proved so little interesting, the excursion was altogether pleasant enough. One of our party, a Jutti, was in high delight as we neared his native place Baglee, which he had not visited for twenty years, though he had been all that time at Indore. It was amusing to watch the eagerness, with which he recognized every old hut, mata, or tree, to most of which some

\* The Sanchun is frequently omitted on old Jain statues, and sometimes, but more rarely, on modern ones. In such cases the saint represented must be guessed at.

† It must be confessed, however, that the Digumbir figures As. Rs. vol. 9, are without it.

‡ The *Sri butch*, which is generally painted as a flower, but carved on an image as if a square ◻ is one of the Jain Asht Munglikas, or eight auspicious symbols, which slightly differ from those of the Budhs. As. R. 16, 460. They are represented in drawing (A.) a copy from a small brass table, sometimes placed before a saint, as a kind of altar. It was picked up by me at a fair, from the miscellaneous rubbish of a Bohra's shop, and may have been plundered from some old temple. At the back is scratched the date 1167. The signs, according to the Jiva Bhagawnt Sutra, 3rd Kund, are the,—1st Swastica,—2nd Sri Butch,—3rd Nandivertha,—4th Censer,—5th Throne,—6th Kullus, (or water)—or 7th the Fish,—8th Looking-glass. The Sri Butch occasionally carved on images of Krishna seems somewhat different from the Jain mark,—if indeed I mistake not in supposing the former to be synonymous with the Brigulata, As. R. 16, 161 ; Preu Sagur 88.

tradition was attached, or a story of the bad old times of the Piudaries. He shewed us, *inter alia*, after much searching, an old Mhowa tree by the road side, the hollow trunk of which was full of water. This he challenged us to empty. "Fill your lotas," he cried out triumphantly, (for we had often before received rather incredulously his tales of this very tree) "fill your lotas all day long, and there will still remain a cupful for the next comer." As the water is sweet, and the hole covered, a spring perhaps rises under this new species of *Arbre voyageur*. A similar reservoir is described in the Journal of the Bor Khampti expedition.

The Raja of Baglee honored us with a visit, and finding that we were curious in such matters, gave a short sketch of his history, and desired the Kool Gooroo, to extract from his papers, any thing they might contain regarding the family. The Raja would seem from his putravali to be a Champawut\* Rahtore. We could not learn the date of the emigration of his ancestors : and indeed the history of the family is but a barren list of names, till we come to Kakul Das ; who, in the middle of the last century, served with a few followers under the Bhopal Nawaubs.

The popular account, of how the strangers first obtained land, appears more romantic than probable. The Nuwaub stuck some very small object, (tradition says a peppercorn,) on the top of a pole, and offered a reward, for whoever should knock it off, without hitting the pole. All having failed, Suktawut Gee, the wife of Salim Sing, the youngest son of Kokul Das' four sons, stepped out, and at the first shot performed the feat : for this, the village of Bamun Kheri was given to her in enam. Baglee, three coss from Bamun Kheri, was at this time in the possession of a Chohan Grassya, named Banki Rao ; who instead of attending to his interests, amused himself daily with boating on a tank, about a mile from Baglee, called the Koomptalao. Salim Sing, taking advantage of this negligence, attacked and took the fort, while its master was absent ; and though the expelled chief made one desperate effort to recover it, he was driven back, and the Rah-tores have ever since kept the place.+ To confirm their power they

\* The Gooroo's tables commence with ten names prior to Jya Chund, the last king of Canoge ; none of which, except the penult have any resemblance to those in Tod's list, or in the new lists elicited from coins, &c. Two princes, Birda Sing and Jutarana, connect Jya Chund with Seoji ; from whom, to Rimmull the names, (allowing for provincial spelling,) strictly correspond with Tod. After Rimmull, comes his third son Champa, from whose time, the catalogue is evidently defective,—seven names occupying a period of more than 300 years.

+ The turned-out Grassya's family still reside, I am told, at Mukhsia, a celebrated Jain Tiruth near Ougein, and receive through our mediation some small annuity.

offered themselves as tributaries to Scindia, and with the usual activity of new settlers, soon cleared away large tracts of the forest; so that when we came to the country, about sixty years\* after the first conquest, they were lords of as many villages. The present Raja, Bheem Sing, is the son of Salim Sing.

From Bijwar, Ashta may be reached by a difficult pass over a range of hills of considerable height. At a village called Magherda, half way, a few handsome Jain statues have been collected and enshrined in a low walled court, some fourteen feet square; where they are worshipped by the ignorant piety of the villagers as *matas*. The court we should have supposed to be a “*bettu*” (A. R. 9; 285), did not that description of temple seem to be peculiar to the Jains of the south. On one of the stones of the wall, there was an inscription in modern Nagari. It was placed at an inconvenient height, and as we were pressed for time, and it evidently contained no date, we did not copy it. The image, which misled the inhabitants of the village, was doubtless a Pudmavati;† who occupies the principal place, while Santinath and some other saints, sit around her; nor could the rustics be expected to know whom this figure represented: for, as is worthy of remark, the lesser Jain deities are rarely to be found amongst ancient ruins; inducing the belief, that their admittance into temples is a modern innovation.

The name of “Deo Burno,” the Hill of Gods, and the hope-inspiring intelligence of a large “Kumbh,” tempted us to make a run from Ashta to a village named Belpan, about fourteen miles north-west of it, and situated close to the boasted Tiruth. On this spot we were assured we should literally find one mass of deities, “tantum statuarum ut alter populus lapidens videretur”—and to give us some notion of the number of the images, (many of which were said to be milkmaids, turned into stone while milking), they borrowed a fable very popular at Kasi; where you are told that one maund of rice will not suffice the worshipper, who should wish to drop only one grain at each shrine.

\* The exact date of the taking of the fort we could not learn; they said the beginning of the current Sumvut.

† Pudmavati you are acquainted with from a notice in the T.R.A.S. but of the forms and legends of the numerous *Dii minores* of the Jain Pantheon very little seems to be known. It is however very necessary to be *au fait* on these subjects before visiting Jain temples, as they are frequently covered with mythological paintings. I had proposed giving some account of the more common ones, but fear I must now abandon the design. They might possibly have been useful in decyphering the ancient Budh paintings.

Of course this report, like every such report, was fabulous. All we saw on the hill, were a few Vishnoo ruins, temples, and broken statues ; some of the latter however exquisitely carved. The supposed milk-maids we found to be a mutilated group of Dyes and Deotas churning the ocean, with mount Mundar and Vasooki. The only temple at present in preservation, or hallowed, is a cave,—from the floor of which, a languid spring issues, filling a small square tank built about it. The water was muddy and not drinkable : but the fount, we were told, sometimes supplied a sweeter beverage,—the pilgrims who assemble here once or twice in the year using no other. Some of the sculptures of the cave, (now sacred to Sheo,) perhaps indicate that it had once been dedicated to Vishnoo,—a very common metamorphosis in South Malwa, seeming to prove the priority of the latter worship in these parts. The Kumbh was merely a large Jain statue at the foot of the hill.

At a village called Gundawul, about five coss from Belpan, there are several ruined Jain temples, two or three large Jain images, called here by the deceptive name of Kumbh, and a Ling mundir, in which stands an image of Gundrub Sein in his human shape, with an ass's head ; there too Vishnoo seems formerly to have reigned, from the sculptures of the Autars about the temple. These places are worth visiting, were it only for the fine bur trees which luxuriate in every village.

The sight of these was the more pleasing, in consequence of their scarcity in the higher ground about Mhow ; whilst in this neighbourhood they are remarkable for their size and beauty. In the latter quality, one at Newri is said to bear the palm ; and another at Untralo near Ashta is very celebrated—but the largest forms the boast of Belpan ; though very lofty it already covers a space of 400 paces, and will doubtless spread much further—for remarking that it had encroached on a field, we said to the owner, who was weeding, “ You must lop off some of the branches of this tree, or your khēt will be destroyed.” “ By no means,” he replied, “ ‘Tis a God, and walks where it lists.”

In the villages of this neighbourhood, you meet with a great variety of Rajpoot tribes,—Bhattis, Seesodias, Solankes, &c. ; a fact accounted for, by the matrimonial custom of a foreign bride being attended by a few of her brethren, who follow her fortunes, and settle in the country of her husband. It is, to me, quite inexplicable, how in the confusion of names, the Rajpoot crime of incest can be avoided ; since (not to mention the Sachas) many of the minor branches even

the Otes and Awuts of the great families, are constantly confounded with their roots, and you will hardly ever get a list of the so-called 36, from a Bhat of this quarter, without his including in it the Chondawuts and Suktawuts, and increasing the number of names to 50, 60, or more. The most respectable of these classes themselves, petty rajas, potails, &c. are in the highest degree ignorant of their heraldry,—presenting in this respect a striking contrast to the purer Rajpoots of Mewar; a large proportion of whom have the *gotra acharya* at their finger ends; while many will repeat the names of their ancestors for ages back.\*

From Ashta to *Sehore* we found nothing deserving mention; but the antiquity ascribed by Tod to Bhopal, stimulated our zeal to search for Budh relics: and we began to indulge in visions of success, on finding a statue of that sect by the road side, half way between *Sehore* and Bhopal—and on being told, that the hills round the city abounded in caves, in some of which we should find inscriptions: yet, after all, our hopes were not realized. The inscriptions in the caves, which were all in modern Nagari, proved to be chiefly dates, names, and prenames, excepting a few of greater length; only one of which however was at all decypherable.† The caves, mere cavities without carving, have a few of them been walled in and inhabited. In one near the old fort, a fakir lately made himself a very cosey dwelling place; but the superstitious women of the town so pestered him, that he fairly ran away from them.

The first impression of a stranger on visiting the city, will be by no means a favourable one. It is entered,—either by a hard, uneven, rocky way (road it cannot be called) with considerable risk to one's horse's knees,—or through heavy sand and mud; for the sandstone when once broken, soon crumbles to dust, and no one will take the trouble of making a firm road, from the trap and kankur which might be easily brought from the neighbourhood. Being built on a hill, there is hardly a public level space in the whole town, with the exception of a spot used as a manège, little bigger than a London riding school; and the narrow streets are choked with dirt.

\* Some of the Jain heads of colleges have astonishing memories on these matters, and assisted by a *Memoria Technica* will repeat such long lists of names—of their *acharyas* for instance, or the minute divisions of the *ginats*—and such whole volumes of verse and prose, as to reconcile our faith to the almost incredible accounts of the oral preservation of their learning, by the Budhs, the Druids, and the Greeks.

† Insc: No. 2. It is hardly worth sending, but to shew the modern character.

The city however, especially if viewed from a height, has a remarkably lively and pleasing appearance: white terraced palaces, and the light domes and minarets of mosques and tombs, peer above the houses in every direction. The rock-bound lake washes the town, and little outworks from the fort, (which has perhaps more of beauty than of strength)\* stretch to the water's brink, and add much to the picturesque of the scene. Nor must we forget to notice the gardens filled with fine trees, and the really splendid baoles, containing numerous shady apartments for the convenience of the traveller. Some of the mosques, &c. may in after times yield matter for the antiquary: for, the Mussulman,—“non in aliâ re damnosior quam in ædificando”—not content with mutilating the detested images, is every day using them as material for his buildings, turning the sculptured part within.<sup>†</sup> A few days before our arrival, a stone tablet from some old temple, in the neighbourhood, containing, it is said, a long inscription, was buried under the foundation of a splendid musjed which the Begum is erecting:<sup>‡</sup> another slab was about to suffer a similar fate,—the authors of the saerilege being in this last instance Jains, but a copy of the inscription was taken before its consignment to earth. Captain Burt has I believe sent it you.<sup>§</sup> As Bhopal is encircled with ruined towns, thefts of this nature are committed very generally by all classes, stones being frequently brought from so great a distance as Bhojpoor.

We could not visit all these ruins; so we preferred passing by Shums-gur, from which the two *bijeks* above alluded to were brought, and which as the nearest to the city, has been the common quarry for ages. We set out in high hopes, for a village, (of which the name has escaped me,) about eleven miles off; which was fabled to possess a marble stone,—Heaven knows, how many yards square,—covered all over with writing. On arriving at the place, the stone was not to be found; and though we teased every soul in the village with questions,

\* Both the fort and citadel are contemptible as fortifications, spite of the famous siege.

† A common practice, J.A.S. 3; 618. Mrs. Meer Hussun, 2; 138, &c.

‡ A buniah who had seen it, consoled us by the assurance that it was about 6 or 700 years old, and related to some Raja or town named Bid (?). That he could read it at all—proves that it was modern.

§ A fragment (No. 3.) that you may verify it is forwarded. We delayed taking a facsimile till our return from Saugor, in the interim a piece which had been chipped off one corner, was lost. We can make no sense of it, though the letters seem plain enough.

no one had ever heard of such a thing. Bhojpoor, four miles further on, was, according to Tod, an ancient Policity ; the present name must therefore be modern, and is probably derived,—not from the more ancient Bhoj, of whom the old song tells

“ Rajah Bhojho bari  
Vedya Jan to sari”—

but from his scarcely less celebrated namesake—the historical puzzle—the father of Udayaditya.\* In support of this supposition, we have the following traditional fragment—here in every one’s mouth—which at least proves, that the only building of consequence at Bhojpoor, was erected at about the period of this later Bhoj, and not improbably to his honor, by his son Udayaditya. It sounds like broken verse, but we could never get the couplet completed.

Muchalpoor ka baolee our Bhojpore ka kumbh,  
Udayapoor ka dehura (were built by one man,) )

Now for the architect of the temple of Udayapur, we have, as will be presently seen, the certain date of A. D. 1049, and there is in the buildings themselves (in the two at least which I have seen) a certain conformity in boldness and grandeur of design, justifying the tradition, which attributes them to one master mind.

The temple of Bhojpoor would be admired in any country. In the centre of a lofty chamber, about thirty-five or forty feet square,† whose light and elegant dome is supported on the four far famed kumbhas, and on a handsome pedestal, stands Deus Loei, a Ling.

It is the peculiar excellence of this building that though the whole is of massive form and material, the parts have been so nicely proportioned and blended together, that it presents an admirable appearance of combined solidity and airiness. Thus for instance, the platform of the Ling is  $21\frac{1}{2}$  feet square, and about ten feet high—a bulk, which if solid, would be out of all proportion to the size of the temple ; but the architect has escaped this reproach, by simply giving it a light and elegant shape. The sketch, though from memory, will serve to explain the plan of it: the lower table is formed of four stones, so neatly fitted together without cement, that it is a point of faith in the neighbour-

\* We postpone our remarks on this riddle, till we shall reach Udayapur, where there is a long inscription bearing upon the question—but not deciding it. Since writing this, the inscription has been noticed, J. A. S. 7 : 1056—I cannot at this place refer to the original to redeem my pledge.

† Some of my pencil notes of this place are effaced, the doubtful measurements are therefore put in italics, the others in figures.

hood to believe them one huge slab. The two upper stories, (if they may be so called,) are similarly composed, and are but little, if at all, less in size; but I need hardly point out, how much the rounding of the edges, and the consequent cushion-like appearance, and even the ornaments at the corners of the upper table, relieve the heaviness, which would seem inseparable from such large blocks of stone. The idol is reached by steps, which being on one side, and half concealed by one of the pillars as you enter, do not detract from the effect of the *coup d'œil*; and this noble and seemingly insulated throne of rock, crowned by a Ling  $7\frac{1}{2}$  feet high and 17 feet 8 inches in circumference, so well accords with the dark pillars which bound it, that it can hardly fail to impose on the approaching worshipper a mixed feeling of awe and admiration. The art of the architect is again displayed in the pillars. It was desirable to adapt them, in some measure, to the necessarily confined boundary of walls, without detracting from their solid grandeur. This has been effected in an ingenious manner. The shaft, (which, if I remember rightly,) rises from a base *six* feet square, is divided into three nearly equal sections. Of these the lower is an octagon, each of whose sides measures  $2\frac{1}{4}$  feet; the sides of the second, also an octagon, are somewhat narrower, or about  $2\frac{1}{3}$  feet; the third has 24 sides, of a little *less* than 2 feet; so that the pillars have the appearance of tapering, while in reality they are nearly of the same thickness throughout. Even after this, the pillars would have but a gloomy look, were it not for the door-way, which, unlike the usual entrance to a temple, occupies nearly the whole of one of the sides of the square. This entrance, it is true, seems to have been enlarged by violence, but it was evidently from the first, lofty and spacious.

The simplicity,—which has been religiously preserved in the walls of hewn stone, in the unornamented pillars, and the plain pedestal of the Ling,—was exchanged in the upper part of the temple for rich and elaborate carving. The dome seems to have been one mass of ornament. I say seems, for alas the barbarian has not spared this beautiful structure, and all that remains of the roof are the sculptured edges. Under the shelter of this fragment, a mere narrow rim, and clustering on the projecting cornices, numerous families of bees have taken up their abode, whose never-silent humming, re-echoed from the hollows, struck me as in melancholy unison with the solemn ruin. We counted no less than fifty-two of their black nests. Never robbed of their honey, and accustomed to the crowds, who at certain seasons assemble to pay their devotions to Bhojeswar, these insects are not the least alarmed or irritated by the noise of strangers, nor even by smoke, to which bees

are in general so averse ; and though at first, it is not a little alarming to find them falling every instant on your face and person, as they get disabled in their constant battles above ; yet they never sting, and you soon become accustomed to their buzzing around, and crawling about you. If once provoked however, their vengeance is dreadful ; and the chief of a Math of Gosains attached to the temple, assured me that on some few occasions when this has happened, it was not safe to approach the place for days. He likewise hinted that if a persecutor of their master approached the Ling, Mahadeo's Fouj would instantly detect him, and probably sting him to death. A Moonshi with us had laughed at the story ; but just at this moment the wind grew high, and the scattered insects were blown about our faces in hundreds : our Mussulman friend evidently thought they had found him out, and much to our amusement, and most especially that of the Mahunt, we observed him quietly stealing off, and saluted him with a peal of laughter.

The Gosains of the Math, above alluded to, reside in a small court in front of the temple. As usual in these monasteries they were very civil and communicative, and though now poor,\* (the few lands on which they have rights affording little else but pasturage,) boasted largely of their former fortunes, and assured us that the establishment was of a very ancient date ; an assertion in some measure borne out by several venerable looking Samadhs, the graves of former Mahunts. They pretend indeed that the Apsara was founded by Bhoj, or that at least it was coeval with the temple ; which claims may not be credited, but cannot be disproved,—all the papers and grants of the Society having been lost (in a fire, I think) many years ago ; which leaves the question in a convenient uncertainty.†

Bhojpoor is at present a small poor village of mud huts, and if we may judge from the scantiness of its ruins, was never a town of any size or consequence. The only building worth visiting besides Bhojeswar, is a Jain temple, remarkable for an image twenty feet high. Statues, of such large dimensions are approached, to be worshipped, by stone steps, which are built close to the wall on either side of the

\* I think the Mahunt calculated the yearly value of the lands at 750 rupees ; the actual members of the establishment are about 30,—the residents not more than 10 or 12.

† Hyat Mahomed of Bhopal renewed their Sunnuds (we could not however get a sight of the Tambaputras,) and from his time only their history can be depended upon. They read to us the list of Mahunts, all whose names have the distinctive termination of Bun.

aints. In talking of these steps I carelessly made use of the word "siri," (instead of paoria or pugtia,) much to the horror of my companion, Jutti. The incorrectness of the term as applied to stone steps, he said was a trifle, but the word itself was unlucky, and of bad omen, which to pronounce in a temple, was almost sacrilege, and to pronounce any where was a breach of good manners, as it is the name of the bier on which a corpse is carried. Close to the Jain temple, (Mr. Wilkinson informs me) there is a cavity in the earth, from which a warm air issues; unfortunately our guide, either stupid or sulky, failed to tell us of the phenomenon, and we lost the opportunity of examining its nature.

Continuing our journey in a southerly direction, some singular looking masses of black rock, cresting a high hill to the right of the road, attracted our attention. They are known by the name, (common in all parts of India to such seemingly art-shaped stones,) of the Pandu, Bhim; and though worshipped by the country folks, (who celebrate fairs there some once or twice a year,) are, we were assured by our guide, mere natural rocks, unfashioned into their present pillar-like form by human hands, and not sanctified by any ancient images or sculpture. A personal verification of the point would have been more satisfactory, but we were obliged to take our informant at his word; as though from their conspicuous position on the brow of the hill they appeared quite close, they were at least nine miles off, and our time only admitted of going as far as Asapuri, two miles from Bhojpoor.

This village should be visited for some very beautiful Vishnooi images; which though their temples have been thrown down by some zealous servants of Mahommud or perhaps of Sheo, are themselves generally unharmed, being concealed and protected by the huge stone beams of their roofs, which seem purposely to have been allowed to fall over them, and under which you must creep to view them. The scattered ruins are richly sculptured, but we will merely specify some of the principal images.

1st. Bhoot Nath Gee, so our guide named it, probably incorrectly; as Bhoot Nath is a form of Mahadeo, and here every thing seems Vishnooi. My pundit called the figure Hunuman, but the tail was wanting.

2nd. A highly ornamented image, the size of life of probably Indra-jit, with a pair of ankleted feet in front; near it a Varaha.\*

\* The worship of Indra-jit, or Megh Nath, seems (as will be seen in the sequel) to be popular in these parts. One of the most beautiful temples in Malwa, and the chief view at Wane, is a shrine of Indra-jit.

3rd. A Shesh Sohai, sculptured with admirable skill and taste. Of a table supported,—at the back, by the stalks of the lotus,—in front on the heads of worshippers,—lies folded the Nag, whose hood shades, as its body furnishes a bed for, the sleeping Bhugwan. The god is represented as Chatoor Bhooja, and is surrounded by attendants, choristers, &c. In front kneels, expecting his waking, Luchmi; before the image are the Churrun, two pair of which are also sculptured on a loose square stone near it.

4th. A curious image of the “Fulfiller of Hope,” from whom the village takes its name; her immense breasts distinguish her as the Indian Juno Lucina.

The drawing represents a small conical cup or basket which appears to issue from her thigh: out of it peeps forth a child’s face, round which the edges of the cup closely fitting, have much the appearance of a baby’s cap.

On the other side of the village lie the ruins of what must have been a very large Jain temple: jungle, and thorns had grown over them; crawling among which, not without difficulty and pain, we discovered,—a statue of Santinath, standing sixteen feet high, a large sitting figure without *sanchun*,—and many smaller images.

At a village near this, we were received with the country welcome of the *kullus*; a few women brought two lotas of water, one put over the other, with a pân leaf at the top, and placing them at our feet, began singing a song, which they expect one to reward by dropping a trifle into the *kullus*. The officiators at this little ceremony are usually those of the lower Jats, such as live in the outskirts of towns, near which they take a position when a great man is passing on any particular occasion, standing silent with their lotas on their heads. They thus waited outside Maheswar, when Hurry Holkar escaped from his prison. Occupied with more important matters, or perhaps having no superfluous cash, he passed them all, it is said, without notice, merely dropping one rupee into the last *kullus*. This so unusual a proceeding was considered most impolitic; the old crones in the neighbourhood shook their heads, and prophesied all manner of evil; and a failure would have been doubtless looked upon as omened by, or consequent on, this ill-timed parsimony. To pay this compliment (*kullus budhana*) is a not uncommon practice; Tod and others allude to it.\*

\* Near Purra and Saush in Afghanistan the old ladies have a less agreeable custom, though somewhat similar to this—they throw water over the traveller and his horse as he approaches, to guard him from the evil eye.

From Bhopal to Sanchi, the villages, (inhabited by Gonds, miserable in appearance, and sunk in the grossest ignoranee) will afford but few ruins, on which the antiquary can exercise his fancy or judgment. Even the temples elsewhere so common, are seldom found here ; or if found, have but little *pooja* made in them, in lieu of the more generally worshipped Deotas of the country—the Bairawas, Lings, and Matas. The villagers pay their adoration to a parcel of small stones arranged in a square or circle, forming walled enclosures of a few yards, with a small gap for an entrance, the stones opposite which, from their larger share of paint, seem the prineipal objects of *pooja*. These gods, with a curious contradiction, (for the stones are rarely so high as a foot,) they call the Burra Deos ; and though they pay a general reverence to the Hindoo Pantheon—for as one of them told me, once a year a goat dies (*bukri murti*) to Kali—these are the powers to whom they look, in the hour of joy or sorrow, round whom they wind the votive thread,\* before whom they throw the marriage *mourt*, and hang up the old plough at the *singust*.† In one of these inclosures we remarked several clubs set up, and on asking the cause, were told that finding all prayers and ceremonies ineffectual to stop a sickness whieh afflicted the neighbourhood at the commencement of this year, they had determined to threaten the great gods with a beating ; and sickness having shortly afterwards ceased, they believe their remedy to have been efficacious.‡ At one village, Sahapoore, two miles south-east from the halting place between Bhopal and Bhilsa we were shewn about forty or fifty (unfortunately we forgot to count) figures of horsemen earved in sandstone, about a foot and a half high, and ranged round a small walled inclosure in an oval ; of the warriors who

\* Made of threads, and commonly seen encircling Lings. The grateful piety of mothers whose infants have survived the small-pox, generally prompts this simple form of devotion.

† The caps made of split date leaf, or false jewellery, of a Hindu bride and bride-groom. When a river is at hand, they are generally thrown into it, otherwise at the feet of some deity. The custom, doubtless of great antiquity, may be traced in other countries—and as one of the many coincidences between Yavan and Hindu manners, which seem to argue a common origin, we may notice the resemblance of the *Sehura* of an Indian maiden, to the tinsel cap of the Athenian bride.

‡ The old plough alone is thus gratefully honored (the iron however taken off) every twelfth year, other worn out articles, brooms, baskets, ghurras, &c. are merely thrown out in a heap.

§ A method of managing the gods of which there is a well known example in History, and one still practised by some of the hill tribes of India.

rode the horses (many of which are richly housed in the native fashion) the legs and spears, and a few heads which lie at the feet of the chargers, alone remain. Not one *body* was to be found, which renders it probable that these fragments have been brought from some other place. We eagerly inquired of the villagers where they came from, their names, their history, and whether there were any more such statues in the neighbourhood : no one was able to give us the slightest information. At last to our reiterated questions, and promises of reward to whoever would shew us any temples—any Deos—a lad replied that he would be our guide to a big god. We toiled after him over several fields, doubting, guessing, and hoping, till he stopped and pointed with a grin (I really believe the half-idiot-looking rogue knew that he was taking us in) to what in our zeal we had quite forgot—the circle of little stones, the Burra Deos. Though we were thus unsuccessful, I am by no means satisfied that a more extended investigation than our time permitted, would not have brought to light some temples or monuments with which these figures were associated, and which might afford some clue to their object and history.\* We only saw one other statue of a horse in this neighbourhood, that of which mention has already been made in the Society's Journal.† It stands unconnected with any other sculpture on the hill from which it has been cut, at a village a mile south-south-west from Sanchi. Supposing these horses to have been originally placed in their present position, several explanations of their history offer themselves, but none that seem to me sufficient; thus, for instance, in Mussulman *astanas*, hundreds of small horses with riders are heaped together in honor of Alexander; but the horses thus offered, are rudely made of burnt clay, while those be-

\* Accompanying is a drawing of one of the images, which we brought away, as the villagers pay them no respect. The walled inclosure rather resembled the ruins of a hut than a place built expressly to receive them.

† Journal Asiatic Society 3; 489, where the *m* of the plan should point S.S.W. instead of S.E. It was buried in earth, all but the head and upper part of the back, and had been so, said the oldest inhabitants of the village, as long as they could remember. Two men cleared out its grave in about 12 hours, and brought to light a rudely fashioned, unornamented figure 12½ feet from head to tail, about 10 feet high, with a head 2½ feet long. The neck and belly are clumsily supported on two columns (if I may so call them) of this shape △ which are cut out of, and still adhere to, the same block of stone from which the horse is carved. On the recess were scratched, rather than engraved, two marks & — The other image at the same place, alluded to in the Journal, is modern and Braminical.

fore us are carefully carved and ornamented ; and such *astanas* seem peculiar to the south of India.\*

The dread of villagers, Shaka Siam,† is represented on horseback with a long spear, as is the Deccan favorite Kunidee Rao, and Pabooji, whose picture may be seen in Tod, and Ramdeo, a Marwari incarnation of Krishn, and many others : or we should at once have set them down as the twenty-four Bagrawuts,‡ had not the worship of those worthies been peculiar to Mewar and the countries near it. It would be a mere waste of time and paper to notice the various forms and seasons in which the horse is worshipped in India ; we will not therefore weary you with a vain parade of research, but content ourselves with

\* As are a large proportion of the customs described in the Quanoon-i-Islam, quod vide page 279.

† A corruption probably of Saka Swami, the Lord of Slaughter, for he is principally worshipped, I am told, on fields where a battle has been fought. His statues are more commonly found in company with those of brother spirits, as Goga, Phurna Gee, &c. but he is said to have a temple to himself, at Nursinghur near Bersiah. The following story related to us by an old villager, will remind you of the black rider of the Hartz. A buniah had to return home from a Mela, but the gains of the day were in his purse—night was coming on—the road was of bad repute, and he feared to go alone. A soldier passing by, offered himself as an escort—No, objected the buniah, you are armed, and I am weak ; you yourself may rob me. Anxious however to get home, and encouraged by reiterated assurances of protection, he agreed to trust himself in the stranger's company, provided he would swear by Shaka Siam to do him no injury. Shaka Siam is between us (beechmen) replied the soldier; but no sooner was the village out of sight, than he robbed the unhappy merchant of not only his money but his clothes, tauntingly exclaiming, Where is your Shaka Siam ? if he be between us why does he not assist you ? Hardly had the words passed his lips, when a tall horseman was seen in the distance—his jet black steed outstripped the wind—one moment, and the soldier was transfixed by the lance of the rider. The poor buniah had closed his eyes in terror—when he looked up, the horseman had vanished—the soldier lay dead at his feet.

‡ That very singular class of people, the Bhopas, who are the Pundas (poojaris) of most of the heroes I have enumerated, carry round the villages a long cloth called a *phow* फौ (similar to the *puts* for which Juggernath is celebrated) on which the history of the twenty-four brothers is painted in glaring colours. I have one six feet long, and a yard high, which, if a novelty, I propose offering to the Society's acceptance ; annexing to it the explanatory legends, which though Tod seems to have thought them unworthy of record, are indispensable to one who wishes to understand the theology of these regions. Pabooji has a *phur* to himself, which shall also be sent if acceptable : of Ram Deo and his worship a description is deferred to another occasion. Tod's Kajastr. 1, 730. 2, 759. [I sent this down to the Society a year ago, but have not heard of its arrival. The rest of my engagements I must beg to renounce ; the fulfilling of them is here impossible.]

citing one instance of the superstition which seems to have some connection with the point we are discussing. In the old Happa Raj, a number of brass images, with horses heads, are ranged on the top of a mountain, and held in great veneration : they seem, says Tod,\* to mark the site of some victory. Till a better explanation be suggested, we may suppose our images to be something of this nature, and ascribe them (*a la mode de Tod and Wilford*) to the Hihyas, who anciently dwelt in this neighbourhood ; though perhaps the horse-worship was rather the characteristic of the children of the sun.

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### ART. III.—*On an Aerolite presented to the Society.*

A short time before the Cabul expedition, I procured through the kindness of the Resident at Indore an Aerolite, which had then lately fallen near Ougein, and of which I have the honor to request the Society's acceptance. Being at the time the stone fell, laid up with fever, I was not able, as I could have wished, to visit the spot on which it lighted, but intelligent persons were sent to report, who gave the following information.

On Sunday the 2nd of Asar (sudi) two stones fell from the sky at the village of Doondhoo Dabun, belonging to Manik Chund, Kaith, seven eoss from Ougein on the Burnuggur road.

It was about nine o'clock in the morning, when a few claps of thunder were heard, but there was no rain : (or to translate my informant's letter literally, a dry cloud thundered once or twice.) Immediately afterwards a sound reached our ears, and we learnt that two stones had fallen, one 200 paces from a Gosaeen's baolee, near the east quarter of the village, the other a stone's throw from the baolee, in a field belonging to Khusal Patail. The last stone dropped one hour and a quarter after the other. Three men were ploughing close to where it fell, who running up to the spot, found that the stone had gone two *hâts* deep in the earth, which had dried up for more than a foot on all sides of the cavity, though the whole ground and beyond that was wet.

\* Tod's Raj. 2, 303. A horse seems to have been an almost universal type of victory, of which the white horse vale in Berkshire is one well known instance. A number of brass images of horses are scattered about Aboo, A. R. 16, 298. The Bheels, says Sir J. Malcolm, make small mud images of horses ; see T. R. A. S. I, 72.

Of these two stones, the smaller (which however when brought to me was nearly the size of a man's head) is the one sent to the Society. A few pieces have been chipped off for specimens. There is nothing peculiar in its appearance. The inside is of the usual grey colour, with here and there small pyrites intermixed. The outside was of a pale brown, and smooth all round. The villagers smeared it over with ochre of which the stain has remained. The other stone has, I understand, had a temple raised over it, at the spot where it dropped. On the same day, a stone fell at Sursanoo (a coss and a half off from Ghorabund) in the Pergunna of Burnuggur, to which last place it has been taken and enshrined as a Ling.

I could not learn that any meteoric light attended the fall of these Aerolites.\*

**ART. IV.—Extracts from the Mohit (the Ocean), a Turkish work on Navigation in the Indian Seas. Translated and communicated by JOSEPH VON HAMMER, BARON PURGESTALL, Aulic Counsellor, and Professor of Oriental Languages at Vienna, &c. &c.**

(Continued from vol. — p —.)

### SECOND CHAPTER.

اوْسُ Of the fundament (Oss) which is generally used of the Solar and Lunar years—the Roman, the Coptian, and Persian year—in seven Sections.

#### SECTION I. *Of the Lunar and Solar years.*

The solar year is of 354 a fifth and a sixth part of a day, and has twelve months (alternatively), one perfect, and the other deficient; if the last month is also a perfect one of thirty days, the year is an intercalar one, the regular alternation in the middle way.

#### SECTION II. *Of the fundament of the Lunar years.*

باقي که التمش فالو<sup>(1)</sup>  
راني دوره ضرب  
ایده سین

The way of obtaining it is to subtract from the years of the *Hedjrat* the imperfect year; for example, of the year 961, you subtract one, and multiply the rest, which is sixty, with four; <sup>(1)</sup> calling the result *Mahssool* (product);

\* See Journal Asiatic Society, 7. 668.

خارج قسمت <sup>(2)</sup>

lay this beside, multiply again sixty with eleven, divide what you obtain with thirty, and add the issue (2) of the division to the *Mahssool*; if that what remains of the thirty, is less than nineteen it is not counted, if it is more it is counted for thirty. The *Mahssool*

اویس <sup>(3)</sup>

and what issues by the division in seven parts, what remains is called the fundament (3).

اُس سبع If there be no fraction, it is called *fundament of the seven*. The beginning is from Tuesday, and the day with which the calculation ends is the first *Moharrem* of the year. If you wish to know the first day of any other month, you must count each two months of the lunar ones for three, viz. the first for two, and the second for one; subtract them of the lunar fundament; if it exceeds seven, that number and the rest gives the fundament; if it is no fraction it is again the *fundament of seven*; the day to begin with is Tuesday, on the last day is the first of the month inquired for. For example, if you wish to know the first of *Moharrem* of the year 961, throw away the hundreds,

کسو ردن <sup>(4)</sup>  
which I suppose

قصور زدن

مأذن (900) and from the rest one; multiply the rest (4) with four, which makes 240; this is called the *Mahssool*; multiply again sixty with eleven, which gives 660; divide it with

30, the quotient is 22, which added to the *Mahssool* gives 262; if you divide this with seven, there remains three for the fundament, beginning with Tuesday, the last day is Thursday, which proves to be the first of *Moharrem*.

Now if you wish to know the first day of any other month, for example the first of *Ramasan*, begin to count from *Moharrem*, which gives eight months, counting *Moharrem* for two, *Isafer* for one, and so on (the first month counting for two, the second for one) so the above eight gives twelve; add to it the fundament of this year (3) you obtain 15; subtracting from it the seven (eontained therein twice) remains one. Beginning again to count from Tuesday, you arrive at the end again to Tuesday, which is the first of *Ramasan*, and so on.

### SECTION III. Of the fundament of the Solar year.

The solar year is called also the year of the *Boroody* (the 12 constellations of the zodiacus) the Roman and Coptic year. The way of finding it is the following. You throw away the hundred and the exceeding year. مائی و کسوری The rest, whatever it may be,

multiply with eleven, the result of the multiplication is called *Mahssool* (product); the rest multiply with seven, throw away 30, divide what remains with 60, subtract the quotient from the *Mahssool*, the remainder is the fundament of fundaments.

اَسْ سَوْنَى      This is the fundament of the Solar, Roman, and Coptic year. Another way to find out this fundament is the following. You must multiply (after having thrown away from the year of the Hedjrat the hundred  $\text{سْمَل}$  and the odd number) the remainder with 10. This is also called *Mahssool*. The remaining 50 you multiply with 3, the result of this question you add to 30, divide the whole, whatever it may be, with 60, add the quotient to the *Mahssool*, and you have then the *fundament of fundaments*; if this number exceeds the number of the solar year, this must be subtracted, and the remainder is the fundament of fundaments. For example, if of the year 961 you wish to find the fundament of the Solar, Roman, and Coptic year, you throw away the hundred and odd number so that 60 remains; multiply with 11, the product is 660, multiplying this with 7, you obtain 420, throw away 30, and divide the remaining 390 with 60, the quotient  $6\frac{1}{2}$  is reckoned as seven; because the half and what is beyond is reckoned as one, and what is below the half is not reckoned at all; subtract this seven from the *Mahssool*, the remainder is 653. Subtracting from this sum the solar year you obtain 288, which is the fundament of fundaments. The second method is as follows ;—of the year 961 you throw away the hundred and unity, multiply the remaining 60 with 70, this gives the *Mahssool* 600; multiply this with 53 you obtain 3180, add to it 30 it makes 3210, which sum divided by 60 gives the quotient 53, adding this to the *Mahssool* you get 653, of which subtracting the solar year you have 288, the fundament of fundaments.

#### SECTION IV. Of the method to know the Solar, that is to say Zodiacial, year.

The beginning of it is the entry of the sun into *Aries*, which is called *Nawrooz Sultauni*, that is the *Sultanic new year*. Be it known to you that the first day of *Nawroz* is the same day (of the week) which follows the next *Nawroz*; for example, if the *Nawroz* falls on Saturday, it will fall the next time on Sunday, and in intercalary years one day more, on Monday. Be it also known to you that the *Nawroz Sultauni* and the intercalary year are not the

same on all points of the globe ; in some years the year will be an intercalary one for places of great longitude, but not for places of lesser longitude, in which the intercalary year is only to come on in the following year ; this is evident to all persons of sound understanding. But to go on with the subject, if you add to the fundament of fundaments the sum of 172 you obtain the fundament of the constellations of the zodiacus ; if this sum be greater than the number of the solar year you subtract it, and the remainder is the fundament. For this operation there is no regard for the intercalary year ; you subtract the fundament of the constellations from the broken lunar year, and if this cannot be, you subtract it from the solar year, add what remains to the broken lunar year, subtract from the whole the solar year, and obtain by this operation in the remainder the number of the days of the zodiacal year ; you assign to each of the twelve constellations its number of days, and the sun shall be in the degree of the constellation in which your calculation ends, the number of the degrees are

<i>Aries,</i>	<i>Taurus,</i>	<i>Gemini,</i>	<i>Cancer,</i>	<i>Leo,</i>	<i>Virgo,</i>
31	31	31	32	31	31
<i>Libra,</i>	<i>Scorpio,</i>	<i>Sagittarius,</i>	<i>Capricornus,</i>	<i>Aquarius,</i>	<i>Pices,</i>
30	30	29	29	30	30.

For example, if you wish to know in which degree the sun is to be found in the year 961, you proceed in the following way. We know by what has been said that the fundament of fundaments in this year is 288 ; add to it 172 it makes 460, subtract from it the number of the solar year, 365 days, there remain 95, which you subtract from the broken lunar year if you can ; as it is impossible in this year to throw away the first of Ramazan, you make the subtraction so that one month is perfect and the other deficient, and counting also the first of Ramazan you obtain 237 ; from this you subtract the above-mentioned 95, there will remain 142 ; of this sum you assign 31 degrees to *Aries*, 31 to *Taurus*, 31 to *Gemini*, 32 to *Cancer*, and the remaining 17 to *Leo*, so that the sun is to be found in the seventeenth degree of *Leo* ; the constellation of *Cancer* has in our days 32 degrees, although ابوعنصر فراهی Aboo Nassr Ferahi mentions in the *Nessab* the following distinction :

XXXI and XXXI, XXXI, XXXII, XXXI, XXXI, are six months  
 XXX, XXX, XXIX and XXIX, XXX, XXX, are the short months  
 لا ولا لا ولا لا شش ماه سنت لل کط و کط لل شهور کونه است  
 But this agrees with the time when the sun in its greatest height is in *Gemini*, now the sun being in its greatest height in *Cancer*, this has

32 degrees, which will change in future time so that the constellation wherein the sun is in its greatest height is always to be of 32 degrees ; be it known also that in the first climate summer falls in the signs of *Aries, Taurus, Gemini* ; autumn in those of *Cancer, Leo, Virgo* ; winter in those of *Libra, Scorpio, Sagittarius* ; spring in *Capricornus, Aquarius, and Pisces* ; in these parts, that is in the northern ones, it is the contrary. If you wish to know in which of the 28 lunar stations the sun rises, you proceed as follows ;—add to the number of degrees in which the sun is found that day, the number 8 ; give to each station 13, except *Spica* to which you give 14, and if the year be an intercalary one you give also 14 to *Resha* ( $\beta$  in the *Andromeda*) ; the beginning of numbering is in our times *el-Anwa* ( $\beta, \gamma, \varsigma, \delta$  in *Virgo*) because the beginning of *Anwa* falls in the 22nd degree of *Spica*, and the end of it in the beginning of *Libra*, that is to say the beginning of it retards eight degrees.

But the stations of the moon proceed with the eighth sky in 70 years one degree, according to which you must operate. Where the number beginning from *el-Anwa*  $\beta, \gamma, \varsigma, \delta$  in *Virgo* terminates at sunset، غروب ذمّة there the station of the moon is rising ; for example—if you wish to know which station of the moon is rising at sunset on the first of Ramazan in the year 961, you find the sun in the seventeenth degree on the 142nd day of the year of constellations. Add to it the number 8, you get 150 ; begin then from *el-Anwa*, the 13th station, counting for each station 13, but to *Spica* 14 ; six days to the 24th station  $\beta$  and  $\xi$  in *Aquarius* ; six days having elapsed since the rise of this station, called *Saadessofood*, so that there remain nearly seven days. Be it known also that the beginning of *el-Anwa* at the end of the 23rd degree of *Spica*, and its retard of eight degrees from the beginning of *Libra*, happened in the year of the Alexandrine era 1749, that is to say in the time when the tables of *Ulagbigh* were made. This book has been composed in the 1865th year of the era of Alexander (the Silencian) 1553 s. e. so that 116 years have elapsed between. In this case each station has moved nearly two degrees in our time, and it is therefore necessary to add to the number of the solar degrees the number *six* ; seventy years hence when the stations shall have proceeded one degree more, the number *five* must be added and so on till the beginning of the 13th station (*el-Anwa*) shall come to the beginning of *Libra*, in which time no number shall be added ; when afterwards the end of *Isarfa* (the 12th station) shall come to the beginning of *Libra* the number 12 must be added, and you

will begin then to count from the beginning of *Isarfa*, and in the same way you proceed through the other stations.

### SECTION V. Of the (*Romi*) Roman year.

It begins with the first day of *Teshreen ewd*; be it known that the day of the week with which it begins precedes the day of the week with which the following year is beginning; for example, if the first day of the year be Sunday, the first day of the next year will be Monday. The fourth part of a day, (which is exceeding every year) gives in four years the intercalary day. In this year the day of the week of the next year is two days later, on Tuesday. It is also to be observed that even in the Roman year the seasons must change in the course of time, which the greatest part of men are unaware of: so in the course of time the months of spring must become those of Autumn: because according to the tables of *Ooloozbey*, there are wanting to the fourth part of the day forming the intercalary, one 28 to the second, and 40 to the third. But as in the Roman years a fourth part is counted, the above said deficiency makes in  $123\frac{1}{2}$  years one day to be added, the cause of it is that the fourth part of a day counted each year is not exactly a fourth, but deficient; which implies the necessity of adding one day more to the above mentioned space of years. For example, the *Nawroozi Sultauni* falling now on the 11th Adas, that is to say March, shall fall after the above mentioned time on the 10th, then on the 9th, and make the four for some calendarian works. The day of *Nawroozi Sultauni* is found mentioned on the 13th of Adas. This book has been translated in the year 1865 of the Sileucian era; the difference since the establishment of that era makes 14 days at the time of its introduction, the beginning of spring; that is, the entrance of the sun in Aries was on the 26th of March; but as a long time has elapsed since people are in general not aware of this era, *Nasicreddin Toosi* (the great astronomer) calls in his treaty celebrated by its name *Si* (Thirty) the Roman year the *veritable* one, but it is not so, *حقیقی* the *veritable* one is the year of constellations commonly called the *Djelatian* year. It is a curious fact that the great astronomers *Mirza Ooloozbey*, *Mir Ghaiaseddin*, *Djemsheed*, *Hazizade Koomi* and *Molla Ali Kooshdji* (on whom be God's mercy!) call in the new Ephemerides the Greek year the solar one, which is a negligence. On the 7th February the first kindling spark *چمران* of spring is falling; on the 4th the second spark; on the 21st the third, after which the cold of winter is broken; on the 26th is the cold day of

the old woman ; on the 18th Agar the beginning of warm winds ; on the 19th July the first canicular day, after which the heat is broken. This is the way in which our astronomers fix their days, but with no reason, because they ought to fix them according to the seasons, and not according to the Roman year, which is not stable.

The way of knowing the Roman year is to add to the fundament of fundaments 10, the sum gives the fundament of the Roman year, subtract it from the broken lunar year, the remainder gives the days of the Roman year, the names of the (*Roomic*) year are with the number of days as follows,

Teshreen I. 31. Teshreen, I. 30. Kanoon I. 31. Kanoon II. 30 and Shooba I. 28. Arer 31. Nisan 30. Ayar 31. Haziran 30. Temooz 31. Ab 31. Eilool 30.

If you wish to know on which day of the Greek year falls the first of Ramazan, add to the fundament of fundaments 288 the number 16, it gives 298, subtract it from the broken lunar year, which not being possible as the number is 237, you must add the number of the solar year, which makes 602, from which you subtract the fundament of the Roman (Greek) year ; the remainder is 304, which you distribute according to the months, and you will find the day to be the last of August. For the Roman (Greek) year the birthday of Jesus, the days of *Khizr* (St. George's) and *Kasim* (St. Demitrius') fall for ever on the same day, but not so the Lent and Easter ; the Lent falls in the simple years between the 2nd of February and 8th of March, and begins from the Monday nearest ; the number of its days is 48, the 49th Sunday being Easter Sunday ; if Lent begins on the 8th of March, Easter falls on the 25th of April, that is to say two days later than *Khidhi Elias* (St. George's) ; if the Lent begins on the 2nd of February, and intercalary years on the 3rd of February ; Easter falls on the 22nd March, 32 days before *Khidhi Elias* : the greatest distance between the two being 35 days.

#### SECTION VI. *Of the Coptic year.*

Add to the fundament of fundaments 342, the sum is the fundament of the Coptic year ; subtract it from the broken lunar year, and the rest will give the days of the Coptic year, the months of which are, *Thom* 30, *Poazhi* 30, *Hathor* 30, *Kihall* (Khiak) 30, *Tybi* 30, *Emsheer* (Makhir) 30, *Bermohat* (Thamenoth) 30, *Birmoode* (Tharmatic) 30, *Tasheesh* (Takhon) 30, *Tayni* 30, *Epiphi* 30, *Mesori* 30. If, for example, you wish to know on which day of the Coptic year falls the first of Ramazan of the year 961, add to the

fundament of fundaments of this year, which is 288, the number 342, subtract the sum 830 from the lunar broken year, which not being possible, you must add to it the solar year; the remaining 285 is the fundament of the Coptic year; subtract it if possible from the lunar year, and if it be not possible add to it the solar year; the number of the broken solar year is 237, the sum gives 802; subtract from it the Coptic fundament 165; the remaining 337 distribute amongst the above said months, giving to each 30 days, you will find the first Ramazan to fall on the 7th of Mesori.

### SECTION VII. *Of the Persian year.*

The beginning of it is the *Yazdjerdian Nawrooz*; be it known that this *Nawrooz* falls regularly in the next year on the day of the week next to that with which it begun in the former, so if it begins this year with Monday it begins next with Tuesday, because there is no intercalary year in the *Yazdjerdian* cyclus. The way, of knowing it, is to throw away the hundred and odd number of the year of the *Hedjra*, and to multiply the rest with 11. Keep what you obtain and multiply it again with 11: add to one of these two products 53, and call this sum *Madjmoo*, divide the second with 30, subtract the quotient *Madjmoo*, from the number which remains beside; if the quotient is less than 19, you do not mind it, if it is greater than 19 you add it to the quotient, subtract the rest of the *Madjmoo* from the broken lunar year, and if this is not possible add to it the solar year; from the sum subtract the *Madjmoo*, the remaining number gives the day of the *Nawrooz*. For example—if you wish to know on which day of the *Yesdedjerdran* year falls the first of Ramazan of the year 961, you throw away the hundred and the odd number of the years of the *Hedjra*, multiply the remaining 80 with 11, which gives 660, add to the first 660 the number 93 which makes 713, and call this *Madjmoo*, divide the second 660 with 30, the quotient of which is 22; subtract this from the *Madjmoo*, and you will obtain 891; subtract of this the solar year and you will get 326. As it is impossible to subtract this sum from the broken lunar year you must add to this the solar, which makes 602, from which you subtract 326, the remaining 276 are the days of the *Yesdedjerdran* year, which you distribute according to the months *Farrardeen* 30, *Ardebehesht* 30, *Khorded* 30, *Tir* 30, *Mordad* 30, *Shahirwer* 30, *Mihs*, 30 *Aben*, 30, *Azes*, 30, *Dei* 30, *Rahman* 30, *Isfendarmed* 30; and you will find the first Ramazan to fall on the tenth of *Dei*.

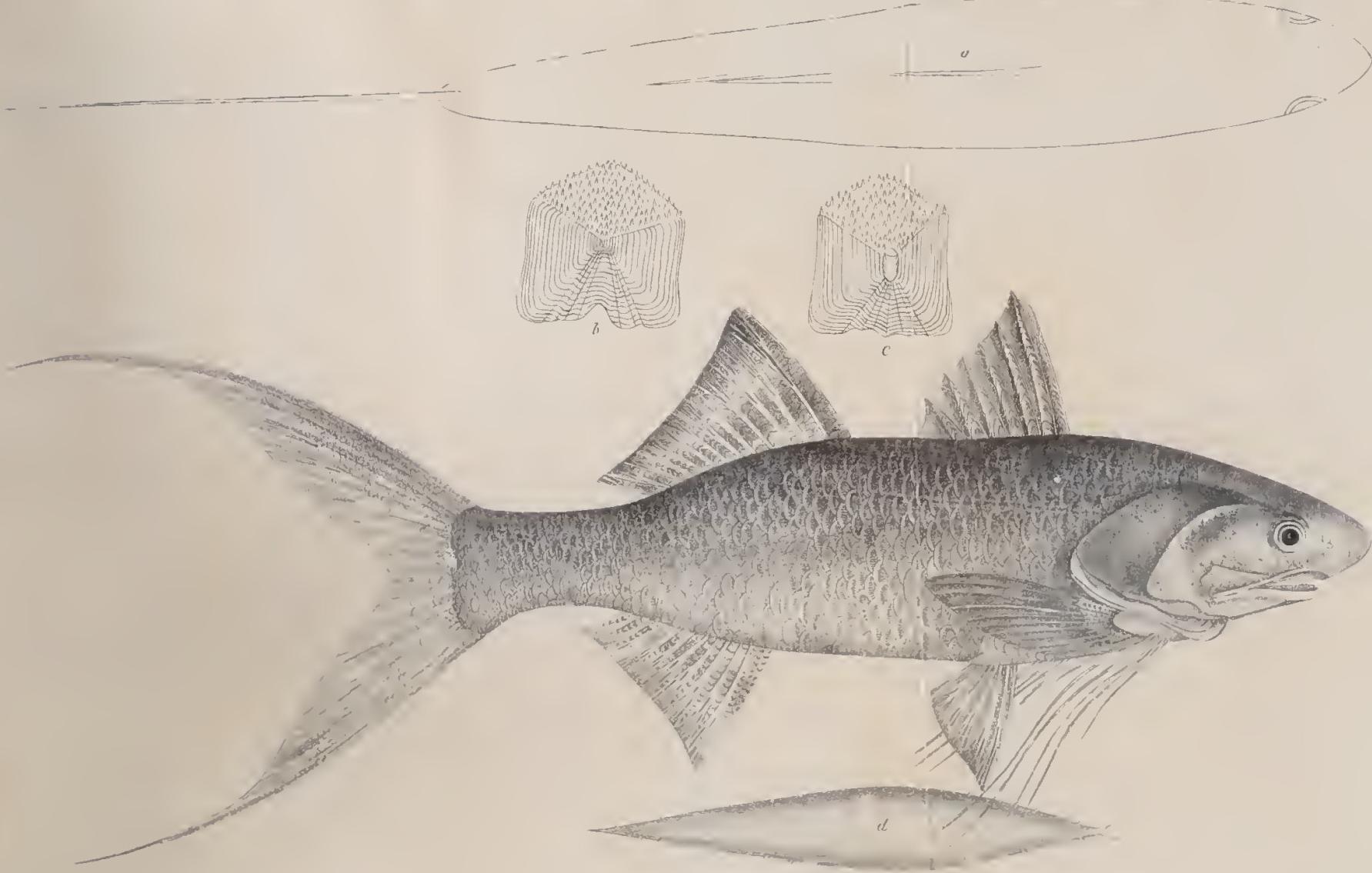
APPENDIX (A.)  
Sugar cultivation in the District of Aziangark.

Name of Pergunnah	No. of Beegahs of Cultivated land in the Pergun- nahs.	Of these are Bee- gahs of Sugarcane.	Average produce of Goor about 12 Ghazeepore maunds per Beegah.	First boiling of Goor gives an average 25 per cent. 1st qual- ity Sugar.	Second boiling of Goor and Molas- ses gives about 10 per cent. of 2nd quality Sugar.	About 15 per cent. of Molas- ses re- mains.	The prices vary with the Season and Markets.						Profit and Loss.						
							Cost of Goor at 2-12 per maund.	Goor being 2-12 per maund the 1st quality Sug- ar should fetch 10 Rs per Ghazeepore maund.	Second quality of Sugar should fetch 7-8 per Ghazeepore maund.	Value of Molasses about 7 Rupees per maund.*	Rs.	As.	Gs.	Rs.	As.	Gs.	Rs.	As.	Gs.
	Beegahs. B. D.	Beegahs. B. D.	Maunds P. C.	Maunds P. C.	Maunds P. C.	Maunds S. C.	Rs.	As.	Gs.	Rs.	As.	Gs.	Rs.	As.	Gs.	Rs.	As.	Gs.	
Nizamabad, .....	2,12,366 7 0	21,236 12 15	2,54,839 26 0	63,709 36 8	25,483 38 10	1,11,677 33 12	7,00,809 0 12	6,37,099 2 0	1,91,129 11 17	1,11,677 13 10	Cost of Goor, .....	7,00,860 0 12 0	12,018 8 16 1	Interest on this at 12 per cent. for 6 months, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	7,12,857 9 8 1	8,28,288 13 17 2	85,371 1 9 1
Mahomedabad, .....	1,36,327 0 0	17,691 10 10	2,11,254 12 0	5,21,813 23 0	21,125 17 3	95,064 17 7	5,80,919 5 1	5,28,135 12 0	1,58,440 11 13	95,061 6 19	Price of 1st quality Sugar, .....	6,37,099 2 0 0	1,91,129 11 17 2	Ditto 2d ditto, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	6,15,866 5 1 0	3,4,856 15 3 2	70,770 3 5 3
Mowmat Bhunjun,	8,663 13 0	866 7 10	10,396 20 0	2,599 5 0	1,039 26 0	4,678 17 0	28,590 6 0	25,991 4 0	7,797 6 0	4,678 6 16	Net profit Co's. Rs., .....	.. .. .. .. .. ..	.. .. .. .. .. ..	Cost of Goor, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	28,590 6 0 0	1,715 6 15 2	3,482 13 1 2
Mahde, .....	1,69,118 0 0	13,088 16 0	1,55,065 21 0	39,266 16 0	15,706 22 6	70,679 20 13	4,31,930 6 8	3,92,664 0 0	1,17,799 3 4	70,679 8 6	Price of 1st quality Sugar, .....	5,28,135 12 0 0	1,58,440 11 13 13	Ditto 2d ditto, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	4,57,816 1 7 1	5,10,463 3 1 1	52,616 11 17 0
Suggree, .....	1,07,135 8 0	10,018 3 5	1,20,217 38 0	30,051 19 8	12,021 31 13	54,098 3 2	3,30,599 5 16	3,00,541 11 0	90,163 5 8	54,098 1 5	Net profit Co's. Rs., .....	.. .. .. .. .. ..	.. .. .. .. .. ..	Cost of Goor, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	3,30,599 5 16 0	19,835 15 5 0	10,273 0 7 3
Deogaon, .....	99,645 2 0	4,655 11 0	55,868 16 0	13,967 4 0	5,586 33 10	25,110 31 4	1,53,638 1 12	1,39,671 0 0	11,901 4 17	25,110 12 10	Interest on this at 12 per cent. for 6 months, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	Price of 1st quality Sugar, .....	3,00,541 14 0 0	90,163 7 8 3	1,53,638 1 12 0	9,218 1 12 0	18,715 11 17 2
Cherakote, .....	38,377 0 0	3,873 6 0	46,179 24 0	11,619 36 0	4,647 38 6	20,915 32 13	1,27,818 14 8	1,16,199 0 0	31,859 11 1	20,915 13 2	Ditto 2d ditto, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	Net profit Co's. Rs., .....	.. .. .. .. .. ..	.. .. .. .. .. ..	1,27,818 11 8 0	7,699 2 18 3	15,570 9 17 2
Kurriat Muttoo, .....	16,221 12 0	1,622 3 0	59,165 32 0	1,866 18 0	1,946 23 3	8,559 21 6	53,530 15 4	48,064 8 0	14,599 5 11	8,759 9 15	Cost of Goor, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	Interest on this at 12 per cent. for 6 months, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	53,530 15 4 0	5,211 13 18 2	6,521 0 8 1
Belhabans, .....	35,210 10 15	3,521 1 0	12,252 24 0	10,563 6 0	1,225 10 6	19,013 26 13	1,16,194 10 8	1,05,631 8 0	31,689 7 1	19,013 10 11	Price of 1st quality Sugar, .....	48,664 8 0 0	14,599 5 11 1	Ditto 2d ditto, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	56,542 13 2 2	6,3,263 13 11 1	14,151 9 19 0
Ghewe, .....	75,813 13 0	5,701 7 0	1,68,016 8 0	17,101 2 0	6,841 24 12	30,757 11 9	1,88,144 8 16	1,71,040 8 0	51,312 2 7	30,787 1 12	Net profit Co's. Rs., .....	.. .. .. .. .. ..	.. .. .. .. .. ..	Cost of Goor, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	1,88,144 8 16 0	11,288 10 15 0	22,919 6 16 0
Nathkoopoor, .....	24,981 8 5	2,217 10 0	26,970 0 0	6,742 20 0	2,697 0 0	12,136 20 0	74,167 8 0	67,425 0 0	20,227 8 0	12,136 8 0	Interest on this at 12 per cent. for 6 months, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	Price of 1st quality Sugar, .....	67,425 0 0 0	20,227 8 0 0	78,617 8 16 0	87,052 8 0 0	9,031 15 4 0
Tilience, .....	72,175 3 0	3,699 5 0	11,391 0 0	11,097 30 0	4,139 4 0	19,975 38 0	1,22,075 1 0	1,10,977 8 0	33,233 1 0	19,975 15 4	Ditto 2d ditto, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	Net profit Co's. Rs., .....	.. .. .. .. .. ..	.. .. .. .. .. ..	1,22,055 1 0 0	7,324 5 18 0	11,871 2 2 0
Kowda, .....	34,631 15 0	3,951 16 0	17,157 21 0	11,861 16 0	4,745 30 6	21,355 36 12	1,30,508 6 8	1,18,644 0 0	35,593 3 2	21,355 11 14	Cost of Goor, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	Interest on this at 12 per cent. for 6 months, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	1,18,644 0 0 0	35,593 3 2 2	15,898 1 13 1
Gopalpur, .....	26,949 7 0	2,917 5 10	35,007 12 0	8,591 33 0	3,500 29 3	15,553 11 6	96,270 1 4	87,518 4 0	26,255 7 11	15,553 4 11	Net profit Co's. Rs., .....	.. .. .. .. .. ..	.. .. .. .. .. ..	Cost of Goor, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	87,518 1 0 0	26,255 7 11 1	11,727 1 1 2
Atrawadea, .....	Included in Tilience, 7,518 15 15	7,518 15 15	92,625 18 0	23,156 14 8	9,262 21 12	41,601 18 1	2,51,519 15 16	2,31,563 10 0	69,169 1 7	41,651 7 4	Interest on this at 12 per cent. for 6 months, .....	.. .. .. .. .. ..	.. .. .. .. .. ..	Price of 1st quality Sugar, .....	2,31,583 10 0 0	69,169 1 7 0	2,51,519 15 16 0	15,283 3 5 2	31,029 8 5 2
Total,....	10,54,301 19 3	1,02,725 13 5	12,32,707 35 0	3,08,176 39 8	1,23,250 31 13	5,54,718 23 2	33,59,916 13 6	30,81,769 11 0	9,21,530 15 8	5,51,715 9 5	The price obtained for the Molasses is sufficient to meet all the expences of the manufac- ture, and to cover the Interest on stock and its wear and tear.	.. .. .. .. .. ..	.. .. .. .. .. ..	Total,....	1,12,667 2 11	.. .. .. .. .. ..	.. .. .. .. .. ..	.. .. .. .. .. ..	.. .. .. .. .. ..

- thread,

Total Pieces and the Value.

Profit.	Total of Cotton cloths, Silk and Tisser.	Total Value.	Total Expences.	Total Profit.
Rs. As. Gs. Cs.		Rs. As. Gs. Cs.	Rs. As. Gs. Cs.	Rs. As. Gs. Cs.
1 825 2 8 0	5,96,628	14,07,509 11 4 0	12,08,563 0 0 0	1,98,946 11 4 0
C 16 0 0 0	21,816	43,917 0 0 0	32,873 8 0 0	11,043 8 0 0
K 302 0 0 0	7,824	12,996 0 0 0	9,282 0 0 0	3,714 0 0 0
A 302 0 0 0	23,092	35,502 0 0 0	24,513 0 0 0	10,989 0 0 0
T 46 0 0 0	61,742	1,01,322 0 0 0	75,697 8 0 0	28,624 8 0 0
M	21,828	27,071 0 0 0	19,515 13 10 0	7,558 2 10 0
I	44,292	75,769 8 0 0	70,366 13 0 0	5,402 11 0 0
S	4,656	57,557 12 8 0	49,913 12 8 0	7,644 0 0 0
C 68 0 0 0	7,852	67,061 12 8 0	56,249 12 8 0	10,812 0 0 0
S	16,581	20,691 0 0 0	16,621 0 0 0	4,083 0 0 0
C	1,752	2,151 0 0 0	1,776 0 0 0	378 0 0 0
I	11,208	18,480 0 0 0	14,843 1 0 0	3,636 12 0 0
T 72 0 0 0	49,968	90,515 15 0 0	78,365 6 8 0	12,150 4 12 0
I	5,616	8,424 0 0 0	7,722 0 0 0	702 0 0 0
	1,711	2,916 0 0 0	2,633 0 0 0	283 0 0 0
B 16 0 0 0	60,896	3,20,068 0 0 0	2,43,208 0 0 0	76,860 0 0 0
77 2 8 0	9,99,136	22,72,308 6 12 0	18,91,635 13 6 0	3,80,672 9 6 0





ART. V.—*Description of an Astronomical Instrument presented by RAJA RAM SING, of Khota, to the Government of India.—By J. J. MIDDLETON, Esq. of the Hindoo College, Calcutta.*

The instrument of which I am about to attempt a description, was presented some time ago by the Raja of Khota to the Government of India, as a very good specimen of its kind. The body of the instrument consists of a square plate of pure and massive silver, in addition to which, on one side, is a plummet or index-rod, which revolves freely in the vertical upon an axis fixed at one of the angles of the plate, and at the termination of a tube of about one-sixth of an inch in diameter, which runs the whole length of one side of the instrument. On the other side an index, consisting of four hands, at right angles to each other, and of nearly the radius of the plate, is screwed on to the centre of the plate, around which it revolves at pleasure. The drawings which accompany this description will render the above observations quite clear.

The Sanscrit inscription on the obverse of the plate, and occupying a triangular space at one of its angles, informs us at once of the class of instruments to which it belongs. The inscription may be rendered as follows—“In the year 1891 Sumbut, (1756) “Shokabdhā, in the “month of Assar, on the 7th day of the moon, the son of Boidhanath, “constructed this astronomical instrument, in accordance with the “principles of an astronomical work, styled *Jontro Chintamony*, “under the direction of Raja Ram Sing of Khota, (blessings be upon “his head) who is an encourager of learned men.”

We learn from this, that the instrument is of very modern construction, a circumstance which however in no way detracts from its substantial interest, since it is not indebted, so far as I can discover, to modern principles of science, but might have been fabricated or used by the Indian astronomer of some thousand years ago. This, and the great rarity of astronomical instruments in India, at least in this part of it, contribute to it considerable importance. Of several learned Brahmins with whom I have consulted regarding the instrument, no one could give any account of it; indeed, with the exception of some unimportant facts, it was to them only a subject of astonishment; some, it is true, had read of such instruments in Bhāskara, and other commentators on the Siddhants, but their notions of them, thus derived, were in the highest degree obscure. No additional fact is necessary to prove how rapidly Indian

astronomy is fading away in its native soil,—a decay which the Brahmins themselves readily admit; and which they attribute to the little encouragement held out to those who profess it. Although the relaxation of the grasp in which the Brahmins have long held the Indian mind, can be no subject of regret, and the discredit of their vaticinations no ground for lament; yet those who delight to trace the history of the human mind, and who contemplate with satisfaction the monuments of its industry and power, must ardently desire that Indian astronomy should be embalmed, as entire and perfect as possible, in scientific history. To effect this, the lover of science should allow no fact to escape him, being assured, that so soon as the sciences of the West have been diffused over India, so soon will Indian astronomy be but a name.

I shall begin my particular description of the instrument by showing its use in finding the time of the civil, or *bhumi sávan*, day, which with the Indian extends from sunrise till sunset. For this purpose the inner quadrantial arc, described upon the obverse of the instrument, is graduated from right to left to fifteen prime divisions, these again being subdivided into six equal parts; the former being the number of *dundas* in half the Indian equinoctial day, and the latter being arcs of ten *pulahs* each, equal to four of our minutes. This will be rendered more plain by the following table of Indian divisions of time.

6 Respirations	=	1 Vicala.
60 Vicala	=	1 Dunda.
60 Dundas	=	1 Nachshatral day*

In order to find the time of the day, the observer places the index rod upon its axis, which is fixed near one extremity of the tube, and raises the instrument in the vertical plane till he can see the sun through the tube; he now marks what part of the circle of time just described is cut by the rod, and reads off the number of hours and minutes, proximately, which the sun has of altitude, and this being added to the time of sunrise, or subtracted from that of sunset, (data which their almanacks supply) gives him the hour of the day. I need scarcely mention, that though the result is not strictly true even within the tropics, yet it is sufficiently so for the Indian astronomer, who diminishes its errors by compensations, a mode of correction to which he is accustomed, and in the application of which he is exceedingly skilful. The outer circle is an arc of the meridian intercepted between the equator and the pole, and is graduated to  $90^{\circ}$ , the divisions being num-

\* Nachshatral day, the time of an entire revolution of the earth.

ered from left to right. By this, the index-rod being adjusted as in the last case, the zenith distance may be readily found ; but when taken in connexion with other parts of the instrument, the latitude of places is also easily found. Before describing the manner in which this is done, however, it may be as well to enter into a brief exposition of the principles involved.

Of all the observations which the Indian astronomer makes, none are so generally important to him as those made with his gnomon and graduated horizontal plane, for any error committed here vitiates almost every calculation to which he is accustomed. When the practical imperfection of this instrument is considered, and the difficulty which the Indian artist has to encounter in its construction and adjustment from the rude tools he uses, it is a matter of much astonishment that he attains such accuracy as he will be presently seen to do.

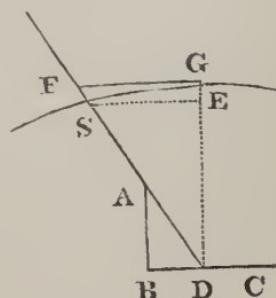
Having fixed a conical gnomon perpendicularly upon a plane, which he graduates into *ungolas*, or digits, each equal to a twelfth part of the height of the gnomon, he again subdivides these into *beungols* or 60ths of an *ungol*. Thus provided, he proceeds at noon on the day of the equinox, to measure the length of the sun's shadow—an operation upon the accuracy of which depends his reputation as an astronomer. Having carefully ascertained the length of the shadow, he next proceeds to the determination of his latitude, which he effects in the following manner :—

Let A B be the gnomon, B C the graduated plane upon which the shadow is to be measured, S A D a ray from the sun S, then B D is the shadow.

Draw D G at right angles to B D, and upon it let fall the perpendicular S E, and from G draw G F perpendicular to D G.

Then  $\sqrt{A B^2 + B D^2} = A D$  by the 47th of Euclid (a proposition well known to Indian mathematicians, and probably borrowed from them) and  $\frac{B D}{A D} = \frac{S E}{D S}$  = the sine of the zenith distance.

Indian mathematicians do not appear to have been acquainted with the nature and use of tangents ; had they been so, they would cer-



tainly have used them in the present case, as their object would thereby have been less indirectly attained ; since  $\frac{BD}{AB} = \frac{GF}{DG} = \tan. \text{zen. dist.}$

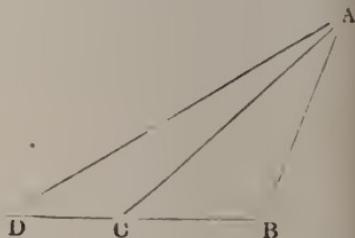
These observations being premised, let us again return to the examination of the plate. It will be observed that its surface within the circles is crossed by equidistant straight lines, intersecting each other at right angles, and that at the twelfth division counting from the angle where the axis of the index-rod is placed along on the one side, the perpendicular has the points of intersection of the other lines numbered 1, 2, 3, 4, &c. If then the outer line thus intercepted by the line last mentioned be taken to represent the axis of the gnomon, the lines 1, 2, 3, 4, will represent the section of its shadow, and if the edge of the rod, adjusted as before, be brought over the number signifying the length of the shadow, that edge will also intercept a segment of the quadrant of latitude equal to the zenith distance. This will readily appear on inspection of the diagram just given. Thus the length of the shadow at any place being known, our instrument at once reveals the latitude.

The only use of this side of the instrument, so far as I can make out, which remains to be explained, is in the determination of heights and distances. To show its usefulness in this respect, little more will be necessary than to adduce an example of its application ; let A B be an inaccessible object standing on the horizontal plane B D, whose height is required.

Observe through the tube the summit A, and mark what division of the line 1, 2, 3, the index allowed to revolve freely on its axis intersects, and let that be, for example, at the number 12 ; then go backwards in a direct line from the object to any new station D and observe the summit of the object as before ; let us suppose that now the edge of the rod is found to intersect at the number 16, then we have  $16-12 : 16 : DC : DB = 4CD$

and  $16 : 4CD : 12 : BA = 3CD$ , the height required.

It is unnecessary to multiply examples, as from the one now given the readiness with which trigonometrical measurements of a simple kind may be effected without the introduction of angular functions, is sufficiently evident. As to the accuracy with which they can be performed, it may be perhaps sufficient to state that, after a little practice, I found



myself able to determine heights and distances with it with very great exactness.

Let us now turn our attention to the reverse side, where, by removing the revolving indices, we meet with numerous letters arranged around the centre in concentric zones, being an arrangement called *lotas*, the Indian metaphor of beauty, and a form peculiarly favoured of Indian sages.

The numbers 1, 2, 3, 4, it will be observed, are written exterior to the outer circle, and indicate the beginning of the four strokes which make up the figure ; the three first being read across, and constituting diameters to the outer circle, the fourth forming the outer circle itself. The following is a translation.

'The length of the shadow of the gnomon at Khota is five unghols and 30 beaugols, in consequence of which the elevation of the signs above the horizon takes place there in times the particulars of which are as follow—

Aries,	3	Dundas,	43	Pulas.
Taurus,	4	"	15	"
Gemini,	5	"	5	"
Cancer,	5	"	41	"
Leo,	5	"	43	"
Virgo,	5	"	33	"

But the other six signs, namely Libra, Scorpio, Sagittarius, Capricornus, Aquarius, and Pisces, are in point of rising above the horizon equal to the former six, when taken in inverse order ; that is to say, Libra rises in the same time as Virgo, and so on.'

The length of the shadow here given is not quite correct,\* at least if I may credit, which I have good reason to do, the result of Mr. Hunter's computations, published in the fourth volume of the Asiatic Researches. According to that careful observer, the latitude of Khota is  $25^{\circ} 11' 41''$ , while the datum of the instrument gives but  $24^{\circ} 37' 25''$ , which, notwithstanding some corrections which I shall presently make, still leaves the latter in defect.

The difference between the latitude of Khota, as calculated by Mr. Hunter, and that deduced from the Indian datum is,  $34' 16''$ ; this is considerable, and is perhaps not entirely attributable to imperfection of instruments or carelessness of observation, but to the

\* The same length of shadow 5 a 30 b is the same as that supposed in the Bhagul-pore tables given by Le Gentil. In both cases the number is suspiciously round, and in both also somewhat inaccurate.

omission of certain elements which the European astronomer takes into account. But little familiarity with astronomy is necessary to an apprehension of the fact that, whatever apparently elevates the sun above his true position must, in the same ratio, diminish the shadow of the gnomon, and consequently the latitude thence deduced. Now refraction does this to a small extent, and the rays of light from the sun's upper limb cause a much greater error of the same kind.

Making the necessary corrections, we have

Difference,	..	..	—	34' 16"
Refraction,	..	..	+	26"
Sun's semidiameter,	..	..	+16'	4"
				—————
True difference,	..	..	—	17' 46"

This is, as I doubt not will be generally allowed, a difference astonishingly small, considering the imperfection of the instrument employed in observation.

Before entering on the examination of the Table of Ascensions of the Signs as given above, it may be as well to inform the reader that after having ascertained the occurrence of any celestial phenomenon, such as an eclipse for instance, in sidereal time, the astronomer next converts this into civil time ; to do which it is necessary that he should know how long each sign occupies in rising. This he effects in the following manner :—

Let us take for example the sign Aries, the place Khota, the length of the equinoctial shadow, as it is given to us, 5 ungols and 30 beungols, and the obliquity of the ecliptic 24°

$$\begin{array}{r}
 1 : \text{Sin } 24 :: \text{Sin } 30 : \text{Sin decl.} \\
 9\cdot6093133 \\
 9\cdot6989700 \\
 \hline
 9\cdot3082833
 \end{array}$$

$$\begin{array}{r}
 12 : 5\cdot5 :: \text{Sin decl.} : \text{Chitija} \\
 8\cdot9207188 \\
 0\cdot7603627 \\
 9\cdot7082833 \\
 \hline
 8\cdot9693648
 \end{array}$$

Cos. decl. : 1 :: Chitija : Sin chara  
 0.0091609  
 8.9693648

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$$8.9785257 = 5^\circ 28' \text{ nearly, —ascensional diff.}$$

Again, the *Lugna* of *Lanca*, or right ascension, is,

$$\begin{array}{r} + 17^\circ 50' \\ - \quad 5^\circ 28' \\ \hline \end{array}$$


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Gives  $22^\circ 22'$  the ascension of the sign *Aries* at *Khota*, which being reduced to *Dundas* gives us  $\frac{22.366}{6} = 3.726 = 3$  dundas 43 pulas nearly, as given on the plate, notwithstanding that my calculations have been performed with logarithms; a sufficient proof, if proof were needed, that where care can save him from error the Indian astronomer is not wanting. It will be seen that I have assumed the obliquity of the ecliptic to have been estimated at  $24^\circ$ , which assumption gives me the true result; this supports the statement made in the beginning of this article, that the instrument is not beholden to modern science for the principles of its construction. Calculating by spherical trigonometry, and assuming the same obliquity, I obtain 3 dundas and 40 pulas for the ascensional arc, giving a difference in time of 3 pulas, or about one of our minutes; an error so small, that even were the Indian astronomer aware of its existence he would disregard it, satisfied that the practical purposes which his labours subserve, are, notwithstanding, carried out with sufficient accuracy.

The zones which bound this side of the instrument alone remain to be explained. There are two of them, with their subordinate circles, the inner serving for an hour circle, the outer for the *Bhagana* or zodiac. It will be observed that in the latter the signs are arranged in pairs, and are referred to the hour circle, of which they occupy segments proportioned to their times of ascension, as given above, while the pairs whose ascensional arcs are equal, are classed together: viz. *Mesha* and *Minah*, (*Aries* and *Pisces*) *Brisha* and *Khumbo* (*Taurus* and *Aquarius*) and so on. The whole zodiac thus occupies an equatorial arc of 12 hours, or 30 dundas.

Indian astronomers divide their zodiac in the same manner as those of Europe, and have equivalent names for their signs, as appears in the following table.

*Divisions of the Zodiac.*

60 Vicalas	=	1 Cala	30 Bhagas	=	1 Rasi
60 Calas	=	1 Bhaga	12 Rasis	=	1 Bhagana.

*Names and order of the Signs.*

Meshia ....	The Ram	Toulahi ....	The Balance
Brisha ....	The Bull	Brishika ....	The Scorpion
Mithouna ..	The Twins	Dhanou ....	The Archer
Corecota ....	The Crab	Mocora ....	The Sea-monster
Singha ....	The Lion	Coumblio ..	The Pitcher
Cunya ....	The Virgin	Meena ....	The Fishes

This is a remarkable fact, and in itself a strong argument against the opinion entertained by some, that the boasted antiquity of Indian astronomy owes its rise to imposture practised by the Brahmins; since it is inconceivable that men capable of perfecting so astonishing a system would have permitted a coincidence so striking, and so encouraging to envy or suspicion, to continue.

The revolving indices, although they might serve the astronomer to illustrate the revolution of the colures, were more probably intended to assist the astrologer in the partition of the celestial concave—an early and important process in the investigation of destiny.

I must not quit this subject without expressing my grateful acknowledgments to Bishonath Turkabhooshuna and Jogodhan Missi, two learned Pundits of this city, for their valuable assistance in translation of the inscriptions.

ART. VI.—*Extract from a Memoir on the Preparations of the Indian Hemp, or Gunjah, (Cannabis Indica) their effects on the Animal system in Health, and their utility in the Treatment of Tetanus and other Convulsive Diseases.—By W. B. O'SHAUGHNESSY, M. D. Professor in the Medical College of Calcutta, &c. &c.*

(Continued from page 745.)

#### SECTION V.

*Experiments by the author—Inferences as to the action of the drug on animals and man.*

Such was the amount of preliminary information before me, by which I was guided in my subsequent attempts to gain more accurate knowledge of the action, powers, and possible medicinal applications of this extraordinary agent.

There was sufficient to show that Hemp possessed in small doses an extraordinary power of stimulating the digestive organs, exciting the cerebral system, of acting also on the generative apparatus. Larger doses, again, were shewn by the historical statements to induce insensibility, or to act as a powerful sedative. The influence of the drug in allaying pain was equally manifest in all the memoirs referred to. As to the evil sequelæ so unanimously dwelt on by all writers, these did not appear to me so numerous, so immediate, or so formidable, as many which may be clearly traced to over-indulgence in other powerful stimulants or narcotics, viz. alcohol, opium, or tobacco.

The dose in which the Hemp preparations might be administered, constituted of course one of the first objects of inquiry. Ibn Beitar had mentioned a *direm*, or 48 grains of *Churrus*, but this dose seemed to me so enormous, that I deemed it expedient to proceed with much smaller quantities. How fortunate was this caution, the sequel will sufficiently denote.

An extensive series of experiments on animals, was in the first place undertaken, among which the following may be cited :

*Expt. 1.*—Ten grains of Nipalese *Churrus*, dissolved in spirit, were given to a middling sized dog. In half an hour he became stupid and sleepy, dozing at intervals, starting up, wagging his tail as if extremely contented, he ate some food greedily, on being called to he staggered to and fro, and his face assumed a look of utter and helpless drunkenness. These symptoms lasted about two hours, and then gradually passed away ; in six hours he was perfectly well and lively.

*Expt. 2.*—One drachm of *Majoom* was given to a small sized dog, he ate it with great delight, and in twenty minutes was ridiculously drunk ; in four hours his symptoms passed away, also without harm.

*Expts. 3, 4, & 5.*—Three kids had ten grains each of the alcoholic extract of *Gunjah*. In one no effect was produced ; in the second there was much heaviness, and some inability to move ; in the third a marked alteration of countenance was conspicuous, but no further effect.

*Expt. 6.*—Twenty grains were given, dissolved in a little spirit, to a dog of very small size. In a quarter of an hour he was intoxicated ; in half an hour he had great difficulty of movement ; in an hour he had lost all power over the hinder extremities, which were rather stiff, but flexible ; sensibility did not seem to be impaired, and the circulation was natural. He readily acknowledged calls by an attempt to rise up. In four hours he was quite well.

In none of these or several other experiments was there the least indication of pain, or any degree of convulsive movement observed.

It seems needless to dwell on the details of each experiment; suffice it to say, that they led to one remarkable result—That while carnivorous animals and fish, dogs, cats, swine, vultures, crows, and adjutants, invariably and speedily exhibited the intoxicating influence of the drug, the graminivorous, such as the horse, deer, monkey, goat, sheep, and cow, experienced but trivial effects from any dose I administered.

Encouraged by these results, no hesitation could be felt as to the perfect safety of giving the resin of Hemp an extensive trial in the cases in which its apparent powers promised the greatest degree of utility.

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#### *Cases of Rheumatism treated by Hemp.*

The first cases selected were two of acute rheumatism, and one of that disease in the chronic form. In the two former but little relief had been derived from a fair trial of antiphlogistic measures, and Dover's powder with antimonials—In the last case, sarsaparilla at first, and subsequently the Hemidesmus Indicus with warm baths had been tried without advantage.

On the 6th November, 1838, one grain of the resin of Hemp was administered in solution, at 2 p. m. to each of these three patients.

At 4 p. m. it was reported that one was becoming very talkative, was singing songs, calling loudly for an extra supply of food, and declaring himself in perfect health. The other two patients remained unaffected.

At 6 p. m. I received a report to the same effect, but stating that the first patient was now falling asleep.

At 8 p. m. I was alarmed by an emergent note from Nobinchunder Mitter, the clinical clerk on duty, desiring my immediate attendance at the Hospital, as the patient's symptoms were very peculiar and formidable. I went to the Hospital without delay, and found him lying on his cot quite insensible, but breathing with perfect regularity, his pulse and skin natural, and the pupils freely contractile on the approach of light.

Alarmed and pained beyond description at such a state of things, I hurried to the other patients—found one asleep, the third awake, intelligent, and free from any symptoms of intoxication or alarm.

Returning then to the first, an emetic was directed to be prepared, and while waiting for it I chanced to lift up the patient's arm. The professional reader will judge, of my astonishment, when I found that it remained in the posture in which I placed it. It

quired but a very brief examination of the limbs to find that the patient had by the influence of this narcotic been thrown into that strange and most extraordinary of all nervous conditions, into that state which so few have seen, and the existence of which so many still discredit—the genuine *catalepsy* of the nosologist.\*

It had been my good fortune years before to have witnessed two unequivocal cases of this disorder. One occurred in the female clinical ward in Edinburgh, under Dr. Duncan's treatment, and was reported by myself for the *Lancet* in 1828. The second took place in 1831, in a family with whom I resided in London. The case was witnessed by Dr. Silver, Mr. G. Mills, and several other professional friends. In both these cases the cataleptic state was established in full perfection, and in both the paroxysm ran on each occasion a regular course, and terminated suddenly without any evil consequence.

To return to our patient, we raised him to a sitting posture, and placed his arms and limbs in every imaginable attitude. A waxen figure could not be more pliant or more stationary in each position, no matter how contrary to the natural influence of gravity on the part.

To all impressions he was meanwhile almost insensible; he made no sign of understanding questions; could not be aroused. A sinapism to the epigastrium caused no sign of pain. The pharynx and its coadjutor muscles acted freely in the deglutition of the stimulant remedies which I thought it advisable to administer, although the manifest cataleptic state had freed me altogether of the anxiety under which I before laboured.

The second patient had meanwhile been roused by the noise in the ward, and seemed vastly amused at the strange aspect of the statuelike attitudes in which the first patient had been placed, when on a sudden he uttered a loud peal of laughter, and exclaimed that four spirits were springing with his bed into the air. In vain we attempted to pacify him; his laughter became momentarily more and more uncontrollable. We now observed that the limbs were rather rigid, and in a few minutes more his arms or legs could be bent, and would remain in any desired position. A strong stimulant drink was immediately given, and a sinapism applied. Of the latter he made no complaint, but his intoxication led him to such noisy exclamations, that we had to remove him to a separate room; here he soon became tranquil, his limbs

\* The subject of the celebrated Article in *Blackwood*, the "Thunder-struck" of the Diary of a late Physician.

in less than an hour gained their natural condition, and in two hours he experienced himself perfectly well and excessively hungry.

The first patient continued cataleptic till 1 A. M., when consciousness and voluntary motion quickly returned, and by 2 A. M. he was exactly in the same state as the second patient.

The third man experienced no effect whatever, and on further inquiry, it was found that he was habituated to the use of *Gunjah* in the pipe.

On the following day it gave me much pleasure to find that both the individuals above mentioned were not only uninjured by the narcotic, but much relieved of their rheumatism; they were discharged quite cured in three days after.

The fourth case of trial was an old muscular cooly, a rheumatic malingerer, and to him half a grain of Hemp resin was given in a little spirit. The first day's report will suffice for all.—In two hours the old gentleman became talkative and musical, told several stories, and sang songs to a circle of highly delighted auditors, ate the dinners of two persons subscribed for him in the ward, sought also for other luxuries I can scarcely venture to allude to, and finally fell soundly asleep, and so continued till the following morning. On the noon-day visit, he expressed himself free from headache or any other unpleasant sequel, and begged hard for a repetition of the medicine, in which he was indulged for a few days, and then discharged.

In several cases of acute and chronic rheumatism admitted about this time, half-grain doses of the resin were given, with closely analogous effects;—alleviation of pain in most—remarkable increase of appetite in all—unequivocal aphrodisia, and great mental cheerfulness. In no one case did these effects proceed to delirium, or was there any tendency to quarrelling. The disposition developed was uniform in all, and in none was headache or sickness of stomach a sequel of the excitement.

#### *Case of Hydrophobia.*

A case now occurred in which the influence of a narcotic, capable either of cheering or of inducing harmless insensibility, would be fraught with blessings to the wretched patient.

On the 22nd November at 8 A. M. a note in English was handed to me by my servant, entreating my assistance for the Hakim Abdullah, then at my gate, who had been bitten by a rabid dog three weeks before, and who feared that the miserable consequences of the bite al-

eady had commenced. I found the poor man in a carriage ; he was perfectly composed, though quite convinced of the desperate nature of his case. He told me that the evening before, on passing near a tank he started in alarm, and since then was unable to swallow liquid. His eye was restless, suspicious, and wild, his features anxious, his pulse 125, his skin bedewed with cold moisture ; he stated nevertheless that he wished for food and felt well ;—a small red and painful cicatrix existed on the left fore-arm.

He was immediately removed to the Hospital, where I accompanied him. By his own desire water was brought in a metallic vessel, which he grasped and brought near his lips ;—never can I forget the indescribable horrors of the paroxysm which ensued. It abated in about three minutes, and morbid thirst still goading the unhappy man, he besought his servant to apply a moistened cloth to his lips. Intelligent and brave, he determinately awaited the contact of the cloth, and for a few seconds, though in appalling agony, permitted some drops to trickle on his tongue,—but then ensued a second struggle, which, with a due share of the callousness of my profession, I could not stand by to contemplate.

Two grains of Hemp resin in a soft pillular mass were ordered every hour ; after the third dose he stated that he felt commencing intoxication—he now chatted cheerfully on his case, and displayed great intelligence and experience in the treatment of the very disease with which he was visited. He talked calmly of drinking, but said it was in vain to try—but he could suck an orange ; this was brought to him, and he succeeded in swallowing the juice without any difficulty.

The Hemp was continued till the sixth dose, when he fell asleep, and had some hours rest. Early the ensuing morning, however, Mr. Siddons, my assistant, was called up to him, and found him in a state of tumultuous agony and excitement ; tortured by thirst he attempted to drink,—but I will spare the reader the details of the horrors which ensued.

The Hemp was again repeated, and again by the third dose the cheering alleviation of the previous day was witnessed. He ate a piece of sugar-cane, and again swallowed the juice—he partook freely of some moistened rice, and permitted other necessary remedies to be used. His pulse was nearly natural, the skin natural in every respect. His countenance was happy. On *one* subject only was he incoherent, and even here was manifested the powerful and peculiar influence of the narcotic. He spoke in raptures of the inmates of his *zenana*, and his anxiety to be with them. We ascertained however that he had no such establishment.

Four days thus passed away, the doses of Hemp being continued. When he fell asleep on waking the paroxysms returned, but were again almost immediately assuaged as at first. Meanwhile purgative enemata were employed, and he partook freely of solid food, and once drank water without the least suffering. But about 3 p. m. of the fifth day he sunk into profound stupor, the breathing slightly stertorous; in this state he continued, and without further struggle death terminated his sufferings at 4 a. m., on the 27th November.

Reviewing the preceding summary of this interesting case, it seems evident that at least one advantage was gained from the use of the remedy—the awful malady was stripped of its horrors;—if not less fatal than before, it was reduced to less than the scale of suffering which precedes death from most ordinary diseases. It must be remembered too that in this the first case ever so treated, I possessed no data to guide me as to the dose or manner of administration of the drug. The remarkable cases of tetanus detailed in the sequel, throw light on these important points, and will lead in future cases to the unhesitating administration of much larger quantities than at first I ventured to employ. I am not however rash enough to indulge the hope which involuntarily forces itself upon me, that we will ever from this narcotic derive an effectual remedy, for even a solitary case of this disease—but next to cure, the physician will perhaps esteem the means which enable him “to strew the path to the tomb with flowers,” and to divest of its *specific* terrors the most dreadful malady to which mankind is exposed.

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While the preceding case was under treatment, and exciting the utmost interest in the school, several pupils commenced experiments on themselves, to ascertain the effects of the drug. In all, the state of the pulse was noted before taking a dose, and subsequently the effects were observed by two pupils of much intelligence. The result of several trials was, that in as small doses as the quarter of a grain, the pulse was increased in fulness and frequency; the surface of the body glowed; the appetite became extraordinary; vivid ideas crowded the mind; unusual loquacity occurred; and with scarcely any exception, great aphrodisia was experienced.

In one pupil, Dinonath Dhur, a retiring lad of excellent habits, ten drops of the tincture, equal to a quarter of a grain of the resin, induced in twenty minutes the most amusing effects I ever witnessed. A shout of laughter ushered in the symptoms, and a transitory state of

cataleptic rigidity occurred for two or three minutes. Summoned to witness the effects, I found him enacting the part of a Raja giving orders to his courtiers; he could recognize none of his fellow students or acquaintances; all to his mind seemed as altered as his own condition; he spoke of many years having passed since his student's days; described his teachers and friends with a piquancy which a dramatist would envy; detailed the adventures of an imaginary series of years, his travels, his attainment of wealth and power. He entered on discussions on religious, scientific, and political topics, with astonishing eloquence, and disclosed an extent of knowledge, reading, and a ready apposite wit, which those who knew him best were altogether unprepared for. For three hours and upwards he maintained the character he at first assumed, and with a degree of ease and dignity perfectly becoming his high situation. A scene more interesting it would be difficult to imagine. It terminated nearly as rapidly as it commenced, and no headache, sickness, or other unpleasant symptom followed the innocent excess.

In the symptoms above described we are unavoidably led to trace a close resemblance to the effects produced by the reputed inspiration of the Delphic Oracles—perhaps it would not be very erroneous to conclude, that it was referable to the same kind of excitement.

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#### *Use in Cholera.*

An epidemic cholera prevailing at this period, two of the students administered the tincture of Hemp in several cases of that disease, and cures were daily reported by its alleged efficacy. Dr. Goodeve was thus led to try it in several cases, and his report was in the highest degree favorable. The diarrhoea was in every instance checked, and the stimulating effects of the drug clearly manifested. The Durwan of the College, an athletic Rajpoot, was attacked, and came under my treatment after he had been ill seven hours; he was pulseless, cold, and in a state of imminent danger, the characteristic evacuations streaming from him without effort—half a grain of the Hemp resin was given, and in twenty minutes the pulse returned, the skin became warm, the urging ceased, and he fell asleep. In an hour he was cataleptic, and continued so for several hours. In the morning he was perfectly well and at his duty as usual.

It is but fair to state, however, that the character of the epidemic was not at the time malignant. I admit the cases to be inconclusive, but I conceive them to be promising, and that they deserve the due attention of the practitioner.\*

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### *Use in Tetanus.*

I now proceed to notice a class of most important cases, in which the results obtained are of the character which warrants me in regarding the powers of the remedy as satisfactorily and incontrovertably established. I allude to its use in the treatment of traumatic *tetanus*, or lock-jaw, next to hydrophobia, perhaps the most intractable and agonizing of the whole catalogue of human maladies.

The first case of this disease treated by Hemp was that of Ramjan Khan, æt : 30, admitted to the College Hospital on the 13th December 1838, for a sloughing ulcer on the back of the left hand. Five days previously a native empiric had applied a red hot *gool* (the mixture of charcoal and tobacco used in the hookah) to the back of the left wrist, as a remedy for chronic dysentery and spleen. The patient's brother was similarly cauterized on the same day. In both sloughing took place down to the tendons. Symptoms of tetanus occurred on the 24th December. The brother who had refused to avail himself of European aid, had been seized with tetanus at his own home four days previously, and died after three days illness. On the 26th of December spasms set in, and recurred at intervals of a few minutes ; the muscles of the abdomen, neck, and jaws, became firmly and permanently contracted. Large doses of opium with calomel having been administered for some hours, without the least alleviation of symptoms, and his case having on consultation been pronounced completely hopeless, I obtained Dr. Egerton's permission to subject the poor man to the trial of the Hemp resin. Two grains were first given at  $2\frac{1}{2}$  p. m., dissolved in a little spirit. In half an hour the patient felt giddy, at 5 p. m. his eyes were closed, he felt sleepy, and expressed himself much intoxicated.

He slept at intervals during the night, but on waking had convulsive attacks.

\* Since this paper was read at the Medical Society a severe epidemic cholera has broken out in Calcutta. I have treated seven cases in the Medical College Hospital, and in all the pulse and warmth returned from the use of this remedy. Five recovered, but all passed through a fever stage.—W. B. O'S.

On the 27th, two grains were given every third hour, (a purgative enema was also administered, which operated three times) the stiffness of the muscles became much less towards evening, but the spasms returned at intervals as before. Pulse and skin natural.

28th.—Improved ; is lethargic but intelligent. Spasms occasionally reoccur, but at much longer intervals, and in less severity.

29th.—Dose of Hemp increased to three grains every second hour. Symptoms moderating.

30th.—Much intoxicated, continues to improve.

1st January, 1839—A Hemp cataplasm applied to the ulcer, and internal use of remedy continued ; towards evening was much improved ; spasms trivial, no permanent rigidity, Dysentery has returned.

2nd.—*Morning report.* Has passed a good night, and seems much better. Hemp continued. *Evening report.* Doing remarkably well.

3rd, 4th, and 5th.—Continues to improve. Hemp resin in two grain doses every fifth hour.

6th.—5 p. m. Feverish, skin hot, pulse quick, all tetanic symptoms gone. Dysentery urgent.

From this day the tetanus may be considered to have ceased altogether, but the dysenteric symptoms continued, despite of the use of opium and acetate of lead ; the ulcer too proved utterly intractable. Some improvement in the dysenteric symptoms occurred from the 10th to the 15th. He seemed gaining strength, but the wound was in no wise improved, the slough on the contrary threatened to spread, and two metacarpal bones lay loose in the centre of the sore ; on consultation it was agreed to amputate the arm, but to this the patient peremptorily objected. The mortification now spread rapidly, and to our infinite regret he died of exhaustion on the night of the 23rd January.

An unprejudiced review of the preceding details exhibits the sedative powers of the remedy in the most favorable light ; and although the patient died, it must be remembered that it was of a different disease, over which it is not presumed that the Hemp possesses the least power.

The second case was that of Chunoo Syee, (treated by Mr. O'Brien at the Native Hospital) in whom tetanus supervened on the 11th December, after an injury from the kick of a horse. After an ineffectual trial of turpentine and castor oil in large doses, two grain doses of Hemp resin were given on the 26th November. He consumed in all 134 grains of the resin, and left the Hospital cured on the 28th December.

*Third case.*—Huroo, a female, æt: 25, admitted to the Native Hospital on 16th December, had tetanus for the three previous days, the sequel of a cut on the left elbow received a fortnight before. Symptoms violent on admission. Turpentine and castor oil given repeatedly without effect; on the 16th and 17th, three grains of Hemp resin were given at bed-time. On the morning of the 18th she was found in a state of complete catalepsy, and remained so until evening, when she became sensible, and a tetanic paroxysm recurred. Hemp resumed, and continued in two grain doses every fourth hour. From this time till the third hour tetanic symptoms returned. She subsequently took a grain twice daily till the 8th of February, when she left the Hospital apparently quite well.

Mr. O'Brien has since used the Hemp resin in five cases, of which four were admitted in a perfectly hopeless state. He employed the remedy in *ten grain doses* dissolved in spirit. The effect he describes as almost immediate relaxation of the muscles and interruption of the convulsive tendency. Of Mr. O'Brien's seven cases, four have recovered.

In the Police Hospital of Calcutta, the late Dr. Bain has used the remedy in three cases of traumatic tetanus, of these one has died and two recovered.

A very remarkable case has recently occurred in the practice of my cousin, Mr. Richard O'Shaughnessy. The patient was a Jew, æt: 30, attacked with tetanus during the progress of a sloughing sore of the scrotum, the sequel of a neglected hydrocele. Three grain doses were used every second hour, with the effect of inducing intoxication and suspending the symptoms. The patient has recovered perfectly, and now enjoys excellent health.

Besides the preceding cases I have heard of two of puerperal trismus thus treated in native females. Both terminated fatally, an event, which cannot discredit the remedy, when it is remembered that the Hindoo native females of all ranks are placed during and subsequent to their confinement in a cell within which large logs of wood are kept constantly ignited. The temperature of these dens I have found to exceed 120° of Fahrenheit's scale.

The preceding facts are offered to the professional reader with unfeigned diffidence, as to the inferences I feel disposed to derive from their consideration. To me they seem unequivocally to shew, that when given boldly and in large doses, the resin of Hemp is capable of

rresting effectually the progress of this formidable disease, and in a large proportion of cases of effecting a perfect cure.

The facts are such at least as justify the hope that the virtues of the drug may be widely and severely tested in the multitudes of these appalling cases which present themselves in all Indian Hospitals.

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*Delirium occasioned by continued Hemp Inebriation.*

Before quitting this subject, it is desirable to notice the singular form of delirium which the inadvertent use of the Hemp preparations often occasions, especially among young men who try it for the first time. Several such cases have presented themselves to my notice. They are as peculiar as the "delirium tremens," which succeeds the prolonged abuse of spirituous liquors, but are quite distinct from any other species of delirium with which I am acquainted.

This state is at once recognized by the strange balancing gait of the patient, a constant rubbing of the hands, perpetual giggling, and a propensity to caress and chafe the feet of all bystanders of whatever rank. The eye wears an expression of cunning and merriment which can scarcely be mistaken. In a few cases, the patients are violent; in many, highly aphrodisiac; in all that I have seen, voraciously hungry. There is no increased heat or frequency of circulation, or any appearance of inflammation or congestion, and the skin and general functions are in a natural state.

A blister to the nape of the neck, leeches to the temples, and nauseating doses of tartar emetic with saline purgatives have rapidly dispelled the symptoms in all the cases I have met with, and have restored the patient to perfect health.

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The preceding cases constitute an abstract of my experience on this subject, and which has led me to the belief that in Hemp the profession has gained an anti-convulsive remedy of the greatest value. Entertaining this conviction, be it true or false, I deem it my duty to publish it without any avoidable delay, in order that the most extensive and the speediest trial may be given to the proposed remedy. I repeat what I have already stated in a previous paper—that were individual reputation my object, I would let years pass by, and hundreds of cases accumulate before publication; and in publishing I would enter into every kind of elaborate detail. But the object I have proposed to myself in these inquiries is of a very different kind. To gather together a few strong facts, to ascertain the limits which cannot

be passed without danger, and then pointing out these to the profession, to leave their body to prosecute and decide on the subject of discussion,—such seems to me the fittest mode of attempting to explore the medicinal resources which an untried *Materia Medica* may contain.

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It may be useful to add a formula for making the preparations which I have employed.

The *resinous extract* is prepared by boiling the rich, adhesive tops of the dried *Gunjah* in spirit (Sp: gr. 835,) until all the resin is dissolved. The tincture thus obtained is evaporated to dryness in a vessel placed over a pot of boiling water. The extract softens at a gentle heat, and can be made into pills without any addition.

The *tincture* is prepared by dissolving three grains of the extract in one drachm of proof spirit.

*Doses, &c.*—In *Tetanus* a drachm of the tincture every half hour until the paroxysms cease, or catalepsy is induced. In *Hydrophobia* I would recommend the resin in soft pills, to the extent of ten to twenty grains, to be chewed by the patient, and repeated according to the effect. In *Cholera* ten drops of the tincture every half hour will be often found to check the vomiting and purging, and bring back warmth to the surface. My experience would lead me to prefer *small* doses of the remedy in order to excite rather than narcotise the patient.

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#### *Postscript.*

While the proofs of this paper were under correction, Dr. Esdaile, of Hooghly, has communicated a case of traumatic tetanus, in which he has used the extract of Hemp and the patient recovered. The details will be subsequently published.

Mr. Sawers, the 1st Member of the Medical Board, has also favored me with the results of a very curious trial of the remedy on a pony which had been attacked by lockjaw as the sequel of forcible compression of the testes. I have the pleasure to insert an extract from Mr. Sawers' note.

"Having made no memorandum of the case of the pony, I am unable to give the particulars in detail. Before the *Bhang* was given the power of mastication had ceased for several days, and he had been supported by mixing *suttoo* (pounded pulse) and bran with his water; with this the powdered *Bhang* was mixed. When he had taken some doses the general rigidity of the muscles was in some degree removed, and he began to masticate hay and grass, and shortly was able to lie down and rise without assistance; but it was sometime ere he recovered the power of balancing the muscles so as to trot evenly.

" I direct the syce to give a little more of the *Bhang* than it was usual for a stout man to take for a *dose*, and it was given for eight or ten days, perhaps longer.

" The pony is now perfectly well. The disease was induced by compression of the spermatic chord, as a mode of castration. *Tetanus* is not so fatal in the horse as in man; of the former I have known several instances of recovery, of the latter, in all my experience I have seen but one case which did not terminate fatally.

" After the battle of Laswarry several wounded Europeans and Sepoys were received into the Hospitals at Agra with *Tetanus*, but they all died. A Sepoy who had a large wound on the outside of his right thigh (which had been brushed by a cannon ball, removing the integuments,) was seized with lock-jaw a few days after his arrival. The only medicines he took were pills of opium and calomel, which he took in large quantity, with occasional aperients;—he recovered. The disease came on gradually, and for many days his jaws were so clenched that the small pills could only be administered by an opening between two of his teeth.

" I ought to have stated that the pony had enemata daily whilst taking the *Bhang*.

Signed,      "J. SAWERS."

ART. VII.—*Memorandum of Experiments on the Explosion of Gunpowder under Water by the Galvanic Battery; with a notice of the successful destruction of the wreck of the "Equitable," at Fultah Reach.—By W. B. O'SHAUGHNESSY, M.D. Assistant Surgeon, &c. &c.*

HAVING recently undertaken a series of experiments on the application of the Galvanic Battery to the explosion of gunpowder under water, with reference to the destruction of the wreck of the barque "Equitable," sunk in the channel of the Hooghly at Fultah Reach, I think it desirable to publish a succinct statement of the results to which these experiments have led.

#### *Description of the Galvanic Battery.*

The galvanic battery which I employed in my experiments is one of my own construction, but on Daniell's constant principle. It consists

of a series of rectangular copper cells, (water-tight) fifteen inches square, and the sides three-fourths of an inch apart. To one lip of the cell is soldered a small copper tube *a* (water-tight) in which a few drops of mercury are contained. One of these cells is shewn in the plate, fig. 1.

Each copper cell is provided with a sheet of zinc plate, fourteen and a half inches square, to which a thick copper wire, seven inches long, is firmly soldered. Each zinc plate is amalgamated with mercury, and enclosed in a pasteboard case, the construction of which deserves attention, as upon it depends much of the action of the battery.

Two sheets of brown pasteboard are cut, of such dimensions that they will freely slide into the copper cells. The pasteboards are then placed over each other, and their edges fastened together at three sides by thin slips of teak, half an inch wide, bound together by a few copper screws. A case or bag of this kind when well made is water-tight at the joints, but allows slow filtration to take place through its sides. One of these cases is shewn at fig. 2.

To arrange each cell the zinc sheet is introduced into the pasteboard case, and this into the copper cell.

Twelve of these cells constitute what we may term one division. The cells must not touch, and are accordingly separated by slips of wood. The zinc sheet from cell No. 1 is connected by its wire with the copper cell No. 2, the zinc of 2 with the copper of 3, and so on, as shewn in fig. 4, in which twelve are placed in a box together.

To excite the battery two different solutions are employed, one a solution of blue-stone (sulphate of copper, *nila tutiya*). This salt costs in the Calcutta bazars about twenty-two rupees per maund.

The second solution is made of sulphate of soda, (Glauber salt *Kari nimuk*), dissolved in warm water, and allowed to cool before use.

Each copper cell is to be filled to two-thirds of its depth with the blue liquid. The pasteboard cases with their zinc sheets are to be steeped in the Glauber salt solution till thoroughly soaked, then slipped into the copper cells, and filled up with the same liquid. The battery is then ready for use.

*Igniting effect produced on platinum or iron wire; how influenced by distance and thickness of conductors, and length of platinum wire.*

I abstain from all explanation as to the theory or mode of action of this battery, wishing to confine myself here to its effects in the ignition of metallic wires.

To produce this effect, twist a copper bell-wire ten feet long to the wire of the last zinc plate, and connect a similar wire with the mercury tube of the first copper cell. If the free ends of these wires be joined by a fine platinum or iron wire, say two inches in length, the moment the junction is completed the platinum or iron becomes white hot, and if the battery be in full action, generally melts into numerous globules. The ready destructibility of iron by oxidation renders it inferior for the purpose now in view to platinum, which was accordingly used in all the subsequent experiments.

But if the copper wires touch each other in any part between the battery and the platinum no heating is produced, because the electrical action does not extend beyond the first metallic junction. This most important fact is made use of in a self-acting apparatus which I employ for the explosion of mines at a certain fixed time after the experimentalist has retired to a safe distance.

It also shews, that when we wish to produce ignition of platinum wire at a distance we must take some means for preventing the conductors from touching each other. But before describing how this may best be accomplished, it is necessary to examine the influence of two important circumstances over the ignition of the platinum wire, viz. the thickness of the conductors, and the distance of the platinum wire from the battery. A few experiments will render this quite intelligible.

A constant battery of twelve cells was employed, and a platinum wire two inches long and 1-30th of an inch in diameter.

*1st Experiment.*—Using copper bell-wire 1-12th of an inch in diameter, this battery caused the platinum wire to become so hot as to kindle saltpetre match-paper at a distance of 130 feet.

*2nd Experiment.*—Each conductor was formed of two strands of bell-wire. The platinum was now heated to the same degree to exactly double the distance of the first experiment.

*3rd Experiment.*—Three strands of wire were now employed in each conductor, twisted into a cord. The igniting distance was rather more than trebled.

My stock of wire was insufficient to carry this curious experiment further; but a trial with a weaker battery and shorter conductors as far as six strands in each, led to the inference, that the igniting distance increases in an arithmetical ratio with the *mass* of the conducting wire.

A very extraordinary circumstance presented itself in these experiments, one which has been previously observed by Davy, but the great importance of which in the present inquiry demands a distinct description.

If at the distance of 130 feet two inches of platinum wire become a bright red, we find that by shortening the wire to one inch the ignition is not increased, but diminishes remarkably. Shortened to half an inch *the wire ceases to be even sensibly warm to the touch!* This curious fact is one deserving all the ingenuity of the theorist to explain its nature, but my business now is with practical matters alone. It leads clearly to the employment of exploding wires of much greater length than we would employ were we ignorant of this very singular and apparently anomalous circumstance.

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*Insulation of conductors not essential even in water.*

The preceding observations refer to *dry* conductors. It is almost needless to say that dividing the wires in any part, and thus interrupting the circuit, at once causes the platinum to return to its natural degree of coldness.

It might be, and indeed generally is supposed, that were the conductors immersed in water, this fluid would carry off the electricity, and nullify all effect on the platinum. Thence it would be inferred that it would be necessary to insulate the wires, that is, to place them within a coating of some resinous, or other non-conducting substance, which would at the same time prove impervious to water and a barrier to the passage of the electric fluid.

Impressed with the idea that this insulation might be dispensed with, I instituted several experiments with the same battery and plati-

num wire already described, using the three-strand conductors led through water in the tank of the Medical College.

The result was, that the conductors being three inches apart from each other, and prevented from mutual contact by pieces of wood, as shewn in fig. 5, the platinum wire ignited gunpowder in a bottle under water, to a distance one-third the length of that at which explosion would occur were the conductors dry.

This fact enabled me in the explosion of the barque "Equitable," hereinafter described, to dispense with the insulation of the conductors altogether, and to use naked three-strand wires, in the ladder-form, as represented in the plate.

It was manifest however that the water did interfere so much as to cut off two-thirds of the electricity in circulation from the standard battery employed. It was also found that approximating the wires towards each other to the distance of one and a half inch, produced a nearly proportionate diminution of the igniting distance. But separating the wires to the distance of three feet did not, on the other hand, materially lengthen the igniting distance. I did not attempt to trace the law by which this effect is regulated—neither time nor means were at my command to do so. But from one and a half inch to three feet constituted the limits within which, in a practical point of view, it was of the least interest to study the phenomenon.

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#### *Floating conductors, construction of.*

The preceding experiments made it manifest that to effect subaqueous explosions in fresh water with perfect certainty, *naked* wires, three inches apart, might be used to the distance or *depth* of 130 feet. It next became a point of interest to learn how far the distance might be extended by floating or insulating the portion of wires not necessarily immersed in water.

Several plans for floating the wires were tried; for example, earthen pots kept at a distance by slips of bamboo were used, but found very unmanageable, the breakage of one pot frequently throwing the whole line into confusion, and sinking so many of these frail vessels as to prevent any certain results being obtained.

I then tried corks, and with complete success. One of the conduc-

tors was led through the axis of each cork, and the cork滑ed along; as it reached its place a brush dipped in melted pitch was applied round the wire, and the cork shoved on the pitched part. In a few seconds the pitch set, and was protected by the cork. The entire of one conductor, 480 feet in length, was thus coated, and at an expense I may observe of fifteen rupees for all the corks required.\*

To the side of this corked wire the second conductor was lashed on by turns of cord. On placing the entire in the tank, I found, to my great satisfaction, that the conductors floated freely, were flexible, light, and manageable in every direction, and that with the battery all along employed, the standard platinum wire was ignited to the same distance as when the conductors were used on land.

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*Mode of insertion and protection of the platinum wire in the mine.*

These experiments left nothing to be desired so far as the battery and conductors were concerned. The next circumstance to be attended to, was the best manner of inserting the platinum wire into the charge of powder, so as to ensure explosion without risking the entrance of water, and with such arrangements as would protect the wires from sudden strains, which might endanger their being torn asunder.

Colonel Pasley, of Chatham, was reported to have led the terminations of the wires through corks, and then to have poured on a cement composed of suet, wax, and pitch. I speak vaguely, not being in full possession of the particulars of Colonel Pasley's method. His conductors were made of wire led through ropes, well insulated by pitch, and surrounded by tarred yarn. It is said that the heavy strain of these rope-conductors frequently tore the wires from the cement, destroyed the platinum loop, and prevented the desired explosion. I do not make this statement in full knowledge of the facts,—it is moreover my most anxious wish not to misrepresent this very distinguished officer; but my object in preparing for the explosion of the "Equitable" was to guard against the evils attributed to Colonel Pasley's system, by common report and newspaper statements.

\* Sola (the subaqueous spongy stems of *Aeschynomene e. paludosa* of Roxburgh) was tried, but was found too-brittle and weak.

My apparatus was thus prepared, see fig. 7—fifteen inches of the thick end of a gun-barrel *g*, *g*, were cut off, and a male screw turned on the barrel near its centre. To this screw was fitted a square plate of iron, half an inch thick by about five inches square *i*, *i*, having a hole at each angle to admit of fastening screws being inserted. A teak rod *t*, *t*, eighteen inches long, was now prepared so that it would just enter the gun-barrel when nearly red hot—two grooves were cut in the opposite sides of this rod, and the conducting wires let into the grooves and securely fastened in with a strip of wood and pitch cement. The rod and wires were then driven into the hot gun-barrel, and the whole immediately plunged in cold water. The contraction which ensued bound the rod and wires so firmly that no force could possibly affect the platinum loop, nor any leakage occur through the iron tube.

An inch and a half of platinum wire (*p*) was next soldered to the end of the conductors, and over these was tied a paper cartridge containing mealed Dartford powder—the cartridge was protected by a copper tube *G*, which screwed on to the end of the gun-barrel, and projected about three inches beyond the platinum loop. This tube was filled with Dartford powder and securely closed by a wooden stopper, cemented into its place by melted pitch.

The ignition of the platinum wire would explode the cartridge, and thus the surrounding Dartford powder, which must burst the tube and explode the contents of the mine in which it was placed.

I may here advantageously anticipate the regular course of this narrative by stating, that the mine for the destruction of the "Equitable" consisted of a barrel-shaped wooden vessel, about seven feet long by three and a half feet in diameter, capable of containing 2,500 lbs. of powder. The square iron plate *i*, *i*, fig. 7. *B*, was screwed into the side of this vessel, which was subsequently enclosed in thick sheet lead. Into the iron plate the priming tube, above described, was firmly screwed, a washer of lead being placed in the joint.

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*Description of self-acting apparatus for igniting the wire at any given moment.*

In compliance with the wishes of Captain Fitzgerald, the engineer officer in charge of the operations for destroying the wreck, it was determined to sacrifice the battery employed, by placing it immediately

over the mine—it therefore became necessary to contrive some self-acting apparatus by means of which the requisite contact of the conductors with the battery could be made at any desired period.

Bearing in mind that all that is required to prevent the ignition of the platinum wire is to cut, or otherwise interrupt, one of the conductors—or else to bring the wires into metallic contact with each other between the battery and the platinum loop—it will be easy to understand the action of the two pieces of apparatus which I now proceed to describe.

The first of these acts by restoring contact between the ends of a divided conductor, thus completing the electric circuit and igniting the wire. But as some unforeseen accident might interfere, and render it necessary to examine the whole arrangement after the mine was laid, a contrivance was added, which after an interval of four minutes would break the circuit again and render every thing safe during examination.

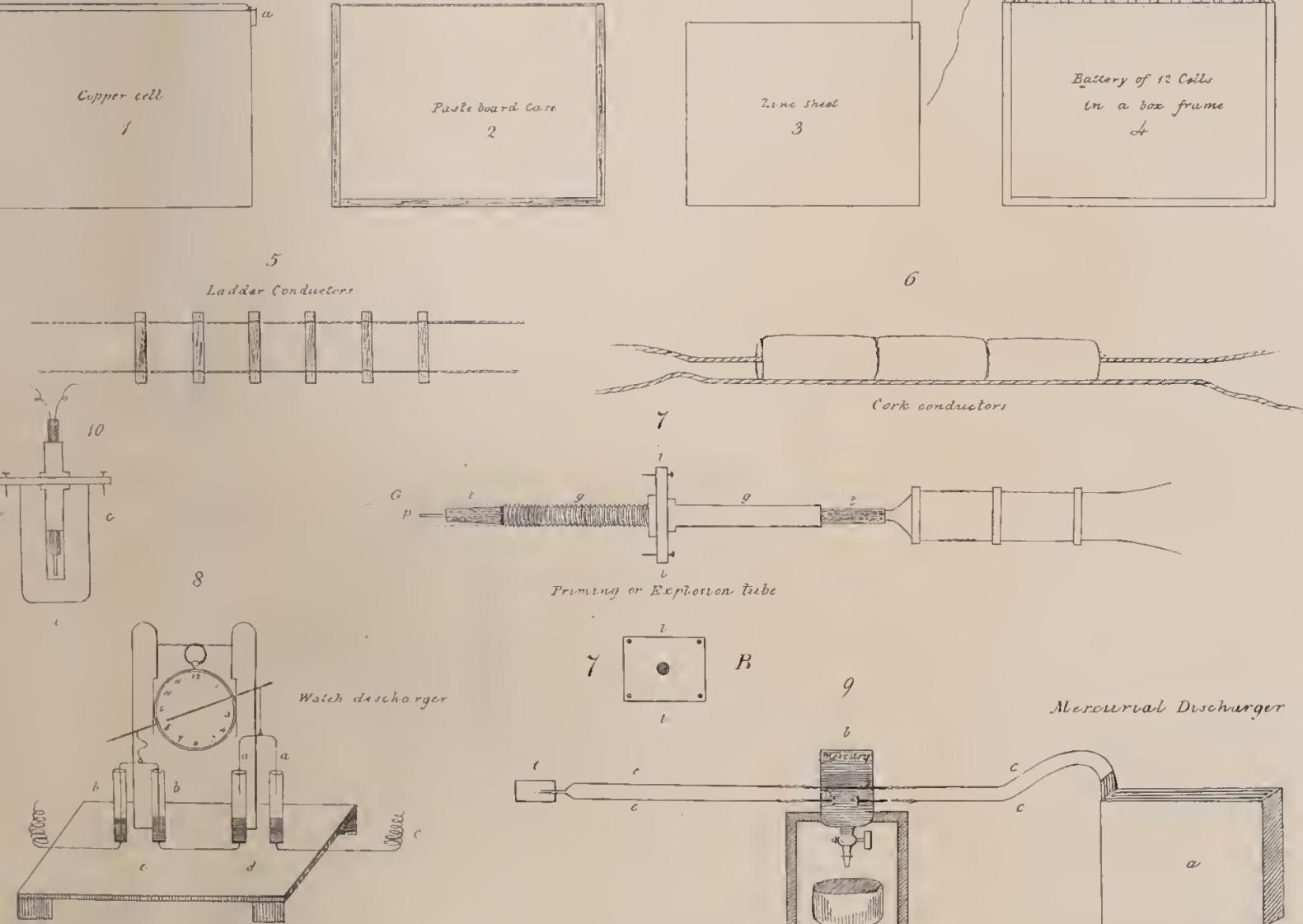
This apparatus is shewn at fig. 8. It consists of a watch from which the minute hand was removed, and its place supplied by a strip of copper four inches long and a quarter of an inch broad, and fixed by its centre to the arbor of the minute hand. Each end of this index carried by a thread a wire bent thus  $\cap$ , the legs dipping into glass tubes fixed in wood, and containing a portion of mercury. As the copper index revolved, its advancing arm gradually lowered the bent wire  $a\ a$  into the tubes, and thus established contact with the battery, one of the conductors of which  $c$ , was interrupted at  $d$  and  $e$ . The opposite arm, also connected with a bent wire  $b\ b$ , would lift this from a similar pair of tubes after a lapse of four minutes, and thus break the contact should no explosion have occurred.

A glance at the figure in the plate will render the plan at once intelligible.

This apparatus could be set so as to go for any period from one to thirteen minutes. The watch employed cost twenty-five rupees.

The second self-acting contrivance was perhaps the simpler of the two, and depended on the fact, that if the conductors come into metallic contact with each other between the battery and the platinum wire, the electricity does not reach the latter, and no ignition occurs,—parting the conductors directs the electric fluid upon the platinum wire, and ignition accordingly ensues.

*Apparatus for the Explosion of Gunpowder under Water  
by the Galvanic Battery*





A joint of bamboo, see fig. 9 *b*, about 5 inches long by  $1\frac{1}{2}$  in diameter, capable of holding 2lbs. of mercury, was fitted with a small brass stopcock below, through which when opened the mercury might escape. It was found by experiment, that when fully open 2lbs. escaped through the stopcock employed in a few seconds more than five minutes.

The bamboo joint was fixed on a wooden frame *ff*, having a vessel below to receive the mercury. A stout copper wire was led through the diameter of the bamboo, one and a half inch from the bottom. A similar wire was inserted three-fourths of an inch below, and in the same direction with the first, and this second wire was divided into two parts, as shewn in the drawing. The ends of the wires were turned into a few loose spirals to allow of their being readily connected with the battery on one side, and with the conductors to the mine on the other.

Suppose this joint filled with mercury, the stopcock shut, and the battery wires connected with it at one side (say the right,) and the mine conductors connected with it at the left—in this case metallic contact being established in the conductors *c*, *c*, between the battery and the mine, no ignition can possibly occur, because the electricity returns to the battery by the first cross road it meets, if I may be permitted to use this homely, but I think expressive, illustration.

If we now open the stopcock and allow the mercury to trickle out as soon as its level subsides below that of the highest copper wire, the only path of the electric fluid now lies through the mine, the platinum becomes ignited, and explosion ensues.

But should any accident have occurred, so that no explosion takes place at once, and should therefore the whole arrangement need inspection, the mercury still subsiding passes after two or three minutes below the second wire, which having been previously cut, the circuit is now completely interrupted, and the whole arrangement is perfectly safe for inspection.

In using this apparatus two things must be attentively borne in mind. No accident can happen while it is full of mercury, but when once emptied it must not be filled again while in connexion with the battery, otherwise an explosion may ensue.

The whole arrangement is shewn in the accompanying diagram, in

which *a* represents the battery, *b* the bamboo mercury cup nearly full of mercury, *c c* the battery conductors, *c' c'* the conductors leading to the explosion tube *t*, containing the platinum wire and priming.

The whole cost of this apparatus, including quicksilver, is not more than six rupees.

It is obvious that many substitutes for the watch apparatus may be devised, and indeed the expense of even the cheapest watch procurable (ten rupees) is an objection, though an insignificant one, to its employment, where circumstances render it advisable to expend all the apparatus by placing it immediately over the mine. In a remarkable set of experiments which I witnessed, portfires were employed instead of the watch—one, six inches in length, supported by a string the wire for establishing the connexion with the battery, corresponding to the watch wires *a, a*—a second portfire, nine inches long, supported a weight, the descent of which was intended to break the connexion in the manner effected by the watch wires *b, b*. In two of the three trials in question the weight did not fall, and the consequence was the imminent danger of the destruction of the party whose duty it was to re-examine and re-adjust the arrangements on the failure of the two first attempts. In one of the trials it was observed too, that one of the tubes containing the mercury was completely choked up by melted saltpetre which had fallen from the portfire during its combustion. These defects seem to me to constitute a most serious objection to the use of portfires; I admit, however, that these are more of a military character than my contrivances—and in this, I believe, their chief merit lies.

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*Explosion of the barque "Equitable."*

The barque "Equitable," bound to Sydney, and laden with wheat, rice, rum, &c. while proceeding down the river in September 1839, touched on Fultah Sand, and instantly turned over in six to seven fathoms water. The wreck lay on her beam-ends athwart Fultah Channel, the keel towards Calcutta. On sounding with the lead, the water over her quarter shoaled to three fathoms, and then suddenly deepened to five or six.

Capt. Fitzgerald, the engineer officer employed, determined to attempt the destruction of the vessel by the explosion of 2,500 lbs. of powder placed between the mizen and main masts, close to the deck.

The cylinder already described was admirably fitted up, under Captain Fitzgerald's directions, in the arsenal of Fort William; before being filled with powder, the exploding tube was screwed into its side, twenty-four barrels of powder were then poured in through an aperture left at the top of the cylinder, which was afterwards closed with wood and *soldered up* with sheet lead.

The cylinder thus prepared was slung on a cradle to the bows of the "Vulcan" anchor vessel, which proceeded down the river and took up her berth at Fultah, immediately over the wreck.

At the slack of the tide, on the 14th December, the preparations for lowering the cylinder being completed, the ends of the ladder-conductor were securely twisted to the wires projecting from the explosion-tube, a piece of wood interposed, and the whole guarded by a joint of bamboo and a wedge. As the cylinder was lowered, my assistant, Mr. Siddons, cautiously permitted the ladder conductors to follow, and when the cylinder was in its berth, the conductors were cut short, so as that their free ends should reach the bow of an old fishing boat, previously moored fore and aft over the wreck. To the bow of this boat the wires were secured by twisting them round screws inserted for the purpose; the length of conductors immersed in the water was thirty-four feet.

The battery and watch apparatus were placed on the boat—the watch set to twelve minutes—and, lastly, the battery wires twisted to the conductors at the bow. The party at the mine consisted of Capts. Fitzgerald and Debude, and Lieut. Smith of the Engineers, my assistant Mr. Siddons, and myself. When all was ready, one of the wires in the battery, purposely left out of its mercury cell to prevent accident, was placed in its position, and our party pulled away vigorously from the dangerous vicinity. At the thirteenth minute a slight concussion was felt in our boat, a sound like that of a very distant and heavy gun at sea was heard, and a huge hemispherical mass of discoloured water was thrown up to the height of about 30 feet. From the centre of this mass there then rose slowly and majestically a pillar of water, intermingled with foam and fragments of wreck, and preserving a cylindrical form till it reached an elevation of at least 150 feet. The column then subsided slowly, a wreath of foam and sparkling jets of water following its descent, and rendering the spectacle one of indescribable beauty.

On pulling to the spot we found the river absolutely thickened by the wreck and cargo of the vessel. By subsequent examination, it was found that with the exception of the forecastle, the "Equitable" had by this explosion been literally torn to pieces. The fishing boat battery, watch, &c. were all "expended."—The ladder conductors were however picked up uninjured half a mile from the wreck.

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In conclusion of this paper—which circumstances induce me to publish sooner than I intended—I think it but just to express my thanks for the zealous assistance afforded me in all the preceding experiments, and in the construction of the apparatus, by Mr. Siddons, of the Medical College.

I should add, that while my experiments were proceeding, my colleague Mr. Egerton, suggested the placing of a strip of saltpetre match-paper round the platinum, in preference to placing this in contact with the powder. The excellence of the suggestion was proved by experiment, for we found on repeated trials that saltpetre match inflames at nearly double the distance at which the wire will explode powder.

The match should be prepared by immersing *cotton* in a saturated solution of the *purest* saltpetre; if the salt be impure the match is liable to become damp, and thus to frustrate the experiment. A few fibres of this cotton should be twisted loosely round the platinum wire.

It is astonishing to observe the great cooling effect produced on the platinum wire by the contact of *apparently* dry powder, if this be in the least degree damp. On one occasion with a new battery in perfect order, with dry conductors only 150 feet long, the standard platinum wire was kept for an hour in a pint bottle of powder just drawn from the canister, and no explosion ensued; but by removing some of the powder, so as to leave only a grain or two on the wire, the mass being half an inch below it in the neck of the bottle, explosion took place the instant the battery contact was effected.

I wish it to be remembered too that the preceding experiments are applicable only to explosions in *fresh* water; operations in salt water would require a special set of experiments, which I have not had the means of instituting on a sufficiently large scale. I have strong reason however to believe that the cork conductors with pitched wires will

succeed effectually in salt water also. Nay, even naked wires after having been used for about an hour as conductors in salt water are, I find, protected or insulated by the coat of oxychloride of copper, which forms on the positive wire.

In subsequent experiments I would recommend a copper or sheet-iron, water-tight, tube to be soldered round the internal orifice of the screw plate into which the explosion tube is inserted (see fig. 10 *c, c, c,*) This would constitute a separate compartment in the mine or cylinder, and in the event of leakage, that portion only of the powder could be spoiled contained within this tube. This alteration I have taken the liberty of recommending to Captain Fitzgerald and Lieut. Smith, the engineer officers employed in these operations.

Lastly, were I again to undertake the destruction of a wreck, I would employ cork conductors secured from the mine to a buoy, and from this I would float 100 yards of conductors to a boat containing the battery and the mercurial discharger. At such a distance I have little doubt but that the whole apparatus, battery, boat, &c. would escape unharmed.

*Calcutta, 20th January, 1840.*

#### ART. VIII.—*Proceedings of the Asiatic Society.*

(*Wednesday Evening, the 4th December, 1839.*)

The Honorable Sir E. RYAN, President, in the chair.

The Proceedings of the last Meeting were read and confirmed.

Captain F. W. BIRCH, proposed at the last Meeting, was balloted for and duly elected a Member of the Society.

His Excellency Sir JASPER NICOLLS, Commander-in-Chief, was proposed by the President, seconded by Colonel D. MACLEOD.

Maharajah RAHAMUT ALI KHAN, Bahadur, was proposed by H. T. PRINSEP, Esq. seconded by the Secretary.

Read a letter from Sir G. C. HAUGHTON, acknowledging his election as an honorary Member.

*To the Secretary of the Asiatic Society.*

14 Grafton Street, Bond Street, London, 18th July, 1839.

SIR,—I beg you will present my best respects to the Asiatic Society of Calcutta, and express to them how much I feel honored by the distinction they have conferred upon me in making me an honorary member of their Society. I am happy that any

little service rendered here on my part has been useful to a Society that has been equalled by few, and surpassed by no other, in the spirit and result of its labors. The names of JONES, COLEBROOKE, WILSON, and though last, certainly not the least, that of Mr. JAMES PRINSEP, (whose melancholy state of health every lover of literature, science, and generous disinterestedness must deplore) will ever form a proud subject of remembrance to the Asiatic Society of Calcutta; and make the republic of letters join in the wish of its founder—*Esto perpetua.*

I need scarcely add, that my humble services will always be at the bidding of the Society.  
I have the honor to be, Sir,

Your very obedient humble servant,

GRAVES C. HAUGHTON.

Read a letter from the Dutch Government, returning thanks to the Society for the books presented on their behalf to Prince HENRY of Orange, during his visit to Calcutta.

*A la Société Asiatique, Calcutta.*

Le Soussigné, chargé d'affaires de sa Majesté le Roi des Pays-Bas, près la cour de la Grande Bretagne, a l'honneur d'envoyer ci joint à la Société Asiatique à Calcutta, une lettre du Ministre de l'Intérieur du Royaume des Pays-Bas par laquelle Son Excellence remercie au nom de sa Majesté Néerlandaise à la dite Société du cadeau qu'elle a fait, à l'occasion du séjour de Son Altesse Royale le Prince Henri des Pays-Bas à Calcutta, de plusieurs ouvrages scientifiques destinés à des institutions savantes du Royaume des Pays-Bas.

BARON BENTINCK.

Londres le 19 Juillet, 1839.

Read the following letter from the Secretary to the Royal Geographical Society regarding the publication of Geographical Memoirs presented to the Asiatic Society of Bengal.

*To the Secretary of the Bengal Asiatic Society, Calcutta.*

*Royal Geographical Society, London, 1st August, 1839.*

SIR,—I have the honor to acquaint you, that in accordance with the suggestion of Major T. B. JERVIS, Surveyor-General of India, the Council of this Society has resolved to present a complete set of its Journal to the public Library of each of the ten principal stations in India, and I have now the pleasure to forward a copy, consisting of nine volumes, for the library of the Asiatic Society of Bengal, which I am to request you will be pleased to present in the name of the Geographical Society of London.

In making this communication, the Council beg to express their hope that this Journal may prove useful to officers who may be about to undertake journeys in the various parts of India, and in the adjacent countries, and to make known to them, that there exists in London a Society specially devoted to the advancement of Geography, which will gladly receive, and publish in the best form, the correct account of any journey in a country of which our Geographical information may be imperfect, as is the case throughout almost the whole continent of Asia.

I am desired to propose to you the exchange, in future, of the Geographical Journal for the admirable Journal of the Asiatic Society of Bengal, which contains so much

valuable Geographical, as well as other information. Should this arrangement meet our views, the subsequent numbers of our Journal shall be dispatched to Calcutta as soon as published.

I am Sir,

Your obedient servant,

JOHN WASHINGTON, *Secretary.*

P S.—The other nine stations are Bonibay, Madras, Bangalore, Hyderabad, Mhow, Dum-Dum, Delhi, Meerut, and Cawnpore; which I mention in order that officers moving from one station to another, and desirous of consulting the London Geographical Journal, may know where to find it.

Read a letter from H. T. PRINSEPS, Esq. Secretary to the Government of India, Political Department, forwarding a Topographical Report, and Meteorological Register of Tatta, by Dr. WINCHESTER.

#### *Library.*

Read a letter from J. P. GRANT, Esq. Officiating Secretary to the Government of India, Revenue Department, forwarding for presentation the following books on the part of Government:—

Illustrations of Indian Botany, No. 9.

Dr. WIGHT's figures of Indian plants, Nos 9 and 10.

The following books were presented:—

Observations relative to the Statistical Reports on the sickness, mortality, and invaliding among the troops in the West Indies. By JAMES MOUAT, Esq. M. D. —by the author.

Proceedings of the Geological Society of London, No. 62,—by the Society.

Transactions of the Medical and Physical Society of Bombay, Volume 2—by the Society.

Transactions of the Royal Society of Edinburgh, vol. 14, part 1st,—by the Society.

Proceedings of ditto, Nos. 13, 14, and 15,—by ditto.

Third, fifth, and sixth Annual Reports of the Managers of the Pennsylvania Institution for the instruction of the Blind,—by the American Philosophical Society.

Pickering's Eulogy on Dr. BOWDITCH, President of the American Academy of Arts and Sciences,—by ditto.

Constitution, Charter, and Bye-laws and Documents relating to the Pennsylvania Institution for the instruction of the Blind—by ditto.

A Discourse occasioned by the death of JULIUS R. FRIEDLANDER,—by ditto.

Proceedings of the Committee of Commerce and Agriculture of the Royal Asiatic Society,—by the Society.

A copy of "Akhlaqi Jelali," translated from the Persian by W. F. THOMPSON, Esq. B. C. S.—by the translator.

On the causes of Bronchocele in India and England—presented by Dr. Malcolmon.

Hammer's GemaldeSal.—by the author.

Hammer's (4 vols.) Mahmud Schebisteris Rosenflor des Geheimnis Persich und Deutch, 3 copies—by the author

Jahrbucher der Literatur, vols. 81, 82, 83 and 84,—by the Editor.

The following books were received from the Oriental Translation Fund:—

Practical Philosophy of the Mohammedan People, being a translation of the *Akh-laki Jalaly*, by W. F. THOMPSON, Esq.

*Kumara Sambhava Kalidasæ Carmen Sanscritæ et Latine* edited by A. F. STENYLER.

*Rigveda Sanhita Sanscritæ et Latine* by F. A. ROSEN.

Lardner's Cabinet Cyclopædia; Statesmen, Vol. 7.

#### Museum.

A curious helmet used by the warriors of the coast of Mergui, with a spear and a couple of shields, were presented by a Member on the eve of his departure for Europe.

#### Antiquities, &c.

Read a note from Mr. JAMES MIDDLETON, on the silver plate presented by Government on the 3rd July last, used for taking observations of altitude, and distance. *Published in the present number.*

Read a letter from Counsellor Von HAMMER, forwarding his translation of the *Mohit*.

#### Physical.

Read a letter from W. SCOTT, Esq. forwarding observations on the Tides at Singapore, for June, July, and August, and stating that in consequence of a Tide Gauge being established by Government, he will discontinue the observations for the Society in future.

Read a note from A. KEAN, Esq. on the Table furnished by Dr. STEWART, and published in the Journal for April last, respecting the Hindu population, and Mortality in each Police division and Thannah of Calcutta, for the year 1837.

Read a letter from Dr. J. G. SPILSBURY, forwarding drawings of Fossil Shells, with plates, by Captain P. A. REYNOLDS, 38th Madras N. I.

*Both the preceding papers have been published in the September number of the Journal.*

#### NOTICES.

*The generous kindness of COLONEL MACLEOD, enables us to present our readers with the spirited and accurate sketch now published of the "Nizamut Palace at Moorshedabad." In binding the volume the sketch should be placed in juxtaposition with the architectural description given at page 552, of the July Number, 1839.*

*In our next Number will be published a sketch on stone of the explosion of the barque "Equitable," from the successful pencil of COLONEL LUARD. We regret that it is impossible to complete this admirable drawing in time for the present Number.*

Day of the Month.	Minimum Temperature observed at Sun-rise.										Maximum Pressure observed at 9 h. 50 m.										Observations made at Apparent Noon.									
	Barometer.					Temperature.					Wind.					Barometer.					Temperature.									
	Moon's Phases.	On the Mercury.	Of the Air.	On an Evapg. Surface.	Aspect of the Sky.	On the Mercury.	Of the Air.	On an Evapg. Surface.	Aspect of the Sky.	Direction.	On the Mercury.	Of the Air.	On an Evapg. Surface.	Aspect of the Sky.	Direction.	On the Mercury.	Of the Air.	On an Evapg. Surface.	Aspect of the Sky.	Direction.	On the Mercury.	Of the Air.	On an Evapg. Surface.	Aspect of the Sky.	Direction.					
1	30,012	66,6	57,9	58,0	Calm.	Clear	30,118	70,5	75,5	E.	Clear.	30,108	71,0	79,5	Clear.	30,021	63,6	56,3	56,9	Clear.	30,118	71,0	79,5	Clear.	30,108	71,0	79,5	Clear.		
2	080	65,8	55,6	55,6	Calm.	Clear	150	69,5	71,0	E.	Clear.	111	72,2	77,0	Clear.	080	62,8	52,0	52,0	Clear.	111	72,2	77,0	Clear.	080	62,8	52,0	52,0	Clear.	
3	073	66,0	57,5	57,2	N.	Clear	106	69,1	70,9	E.	Clear.	082	72,5	81,0	Clear.	073	63,8	57,0	57,0	Clear.	082	72,5	81,0	Clear.	073	63,8	57,0	57,0	Clear.	
4	076	67,0	58,0	58,0	N.	Clear	112	70,0	73,2	E.	Clear.	116	75,9	82,7	Clear.	076	63,8	56,5	56,5	Clear.	116	75,9	82,7	Clear.	076	63,8	56,5	56,5	Clear.	
5	086	68,2	60,5	60,5	N.	Clear	130	70,9	75,9	E.	Clear.	094	74,5	81,0	Clear.	086	68,2	60,5	60,5	Clear.	094	74,5	81,0	Clear.	086	68,2	60,5	60,5	Clear.	
6	064	68,5	60,0	61,0	N.	Clear	110	71,2	78,0	E.	Clear.	050	74,6	79,9	Clear.	064	68,5	59,0	60,0	Clear.	050	74,6	79,9	Clear.	064	68,5	59,0	60,0	Clear.	
7	050	68,9	59,0	60,0	Calm.	Clear	102	72,0	76,2	E.	Clear.	069	71,5	75,5	Clear.	050	67,9	60,0	60,0	Clear.	069	71,5	75,5	Clear.	050	67,9	60,0	60,0	Clear.	
8	048	67,6	60,7	60,5	N.	Clear	069	71,5	75,5	E.	Clear.	036	70,5	72,6	Clear.	048	67,6	60,7	60,5	Clear.	036	70,5	72,6	Clear.	048	67,6	60,7	60,5	Clear.	
9	000	67,9	60,0	60,0	N.	Clear	054	70,1	72,0	E.	Clear.	054	70,1	72,0	Clear.	000	65,9	58,9	58,9	Clear.	054	70,1	72,0	Clear.	000	65,9	58,9	58,9	Clear.	
10	009	65,9	58,9	58,9	Calm.	Clear	054	70,1	72,0	E.	Clear.	088	70,0	74,9	Clear.	009	64,2	58,5	59,0	Clear.	088	70,0	74,9	Clear.	009	64,2	58,5	59,0	Clear.	
11	026	64,2	58,5	59,0	Calm.	Clear	012	69,8	72,9	E.	Clear.	012	69,8	72,9	Clear.	026	63,8	57,0	58,0	Clear.	012	69,8	72,9	Clear.	026	63,8	57,0	58,0	Clear.	
12	29,970	63,8	57,0	58,0	Calm.	Clear	29,996	68,7	74,0	E.	Clear.	30,010	66,1	72,7	Clear.	29,970	63,8	57,0	58,0	Clear.	30,010	66,1	72,7	Clear.	29,970	63,8	57,0	58,0	Clear.	
13	912	63,2	56,9	58,0	Calm.	Clear	034	66,0	70,6	E.	Clear.	034	66,0	70,6	Clear.	912	63,2	56,9	58,0	Clear.	034	66,0	70,6	Clear.	912	63,2	56,9	58,0	Clear.	
14	965	62,9	54,9	56,0	Calm.	Clear	102	67,3	70,9	E.	Clear.	066	67,3	70,9	Clear.	965	62,9	54,9	56,0	Clear.	066	67,3	70,9	Clear.	965	62,9	54,9	56,0	Clear.	
15	990	60,2	54,0	56,0	Calm.	Clear	066	66,5	70,5	E.	Clear.	066	66,5	70,5	Clear.	990	60,2	54,0	56,0	Clear.	066	66,5	70,5	Clear.	990	60,2	54,0	56,0	Clear.	
16	30,066	58,9	53,0	51,9	Calm.	Clear	102	67,3	70,9	E.	Clear.	066	66,4	70,9	Clear.	30,066	58,9	53,0	51,9	Clear.	066	66,4	70,9	Clear.	30,066	58,9	53,0	51,9	Clear.	
17	29,982	57,1	51,3	52,9	Calm.	Clear	066	66,5	72,5	E.	Clear.	088	67,8	72,0	Clear.	29,982	57,1	51,3	52,9	Clear.	088	67,8	72,0	Clear.	29,982	57,1	51,3	52,9	Clear.	
18	029	59,7	52,0	53,5	Calm.	Clear	066	67,5	71,2	E.	Clear.	066	67,5	71,2	Clear.	029	59,7	52,0	53,5	Clear.	066	67,5	71,2	Clear.	029	59,7	52,0	53,5	Clear.	
19	060	62,0	51,5	55,9	Calm.	Clear	066	67,5	71,0	E.	Clear.	066	67,5	71,0	Clear.	060	62,0	51,5	55,9	Clear.	066	67,5	71,0	Clear.	060	62,0	51,5	55,9	Clear.	
20	072	61,9	56,8	57,1	N.	Clear	066	67,5	71,0	E.	Clear.	066	67,5	71,0	Clear.	072	61,9	56,8	57,1	Clear.	066	67,5	71,0	Clear.	072	61,9	56,8	57,1	Clear.	
21	089	61,5	56,0	57,0	Calm.	Clear	066	67,5	70,5	E.	Clear.	066	67,5	70,5	Clear.	089	61,5	56,0	57,0	Clear.	066	67,5	70,5	Clear.	089	61,5	56,0	57,0	Clear.	
22	027	65,0	59,0	58,5	Calm.	Clear	066	67,6	70,8	E.	Clear.	066	67,6	70,8	Clear.	027	65,0	59,0	58,5	Clear.	066	67,6	70,8	Clear.	027	65,0	59,0	58,5	Clear.	
23	020	61,8	58,5	58,5	Calm.	Clear	066	67,7	70,9	E.	Clear.	066	67,7	70,9	Clear.	020	61,8	58,5	58,5	Clear.	066	67,7	70,9	Clear.	020	61,8	58,5	58,5	Clear.	
24	018	63,0	55,9	55,9	Calm.	Clear	066	67,7	70,9	E.	Clear.	066	67,7	70,9	Clear.	018	63,0	55,9	55,9	Clear.	066	67,7	70,9	Clear.	018	63,0	55,9	55,9	Clear.	
25	061	59,5	53,0	53,5	Calm.	Clear	066	67,8	70,9	E.	Clear.	066	67,8	70,9	Clear.	061	59,5	53,0	53,5	Clear.	066	67,8	70,9	Clear.	061	59,5	53,0	53,5	Clear.	
26	017	59,3	52,9	52,9	Calm.	Clear	066	67,8	70,9	E.	Clear.	066	67,8	70,9	Clear.	017	59,3	52,9	52,9	Clear.	066	67,8	70,9	Clear.	017	59,3	52,9	52,9	Clear.	
27	050	60,8	51,5	55,5	Calm.	Clear	066	68,0	72,4	E.	Clear.	066	68,0	72,4	Clear.	050	60,8	51,5	55,5	Clear.	066	68,0	72,4	Clear.	050	60,8	51,5	55,5	Clear.	
28	026	63,1	57,0	57,0	N.	Clear	066	66,6	70,0	E.	Clear.	066	66,6	70,0	Clear.	026	63,1	57,0	57,0	Clear.	066	66,6	70,0	Clear.	026	63,1	57,0	57,0	Clear.	
29	069	61,0	54,0	55,0	Calm.	Clear	30,054	66,3	69,4	E.	Clear.	30,054	66,3	69,4	Clear.	069	61,0	54,0	55,0	Clear.	30,054	66,3	69,4	Clear.	069	61,0	54,0	55,0	Clear.	
30	086	58,2	51,5	52,2	Calm.	Clear	138	63,9	66,5	E.	Clear.	138	63,9	66,5	Clear.	086	58,2	51,5	52,2	Clear.	138	63,9	66,5	Clear.	086	58,2	51,5	52,2	Clear.	
Mean	20,9	61,9	57,7	59,5			20,9	68,8	72,3			20,9	68,8	72,3		20,9	63,6	56,3	56,9		20,9	68,8	72,3		20,9	63,6	56,3	56,9		

Day of the Month.	Maximum Temperature observed at 2 p. m. 40 m.										Minimum Pressure observed at 4 p. m.										Observations made at Sun-set.	Rain Gage.								
	Temperature.					Wind.					Barometer.					Temperature.					Barometer.									
	On the Mercury.	Of the Air.	On an Evapg. Surface.	Aspect of the Sky.	Direction.	On the Mercury.	Of the Air.	On an Evapg. Surface.	Aspect of the Sky.	Direction.	On the Mercury.	Of the Mercury.	Of the Air.	On an Evapg. Surface.	Aspect of the Sky.	Direction.	On the Mercury.	Of the Mercury.	Of the Air.	On an Evapg. Surface.	Aspect of the Sky.	Direction.	Upper.							
1	30,080	81,0	72,2	91,9	E.	Clear	30,050	72,6	78,5	E.	Clear	028	71,5	78,0	68,8	N.	Clear	026	73,0	78,5	69,9	N.	Clear	013	71,0	73,8	68,0	Calm.	Clear	
2	050	71,9	78,9	69,0	N.	Clear	026	73,0	78,5	E.	Clear	017	73,8	82,0	74,5	N.	Clear	026	73,0	78,5	73,0	N.	Clear	013	72,5	74,6	68,9	Calm.	Clear	
3	046	73,1	79,0	71,0	N.	b. c.	026	73,0	78,5	E.	Clear	066	73,5	82,5	71,0	n. w.	Clear	066	73,5	82,5	71,0	n. w.	Clear	038	72,5	74,6	68,9	Calm.	Clear	
4	029	73,5	83,9	74,9	191,0	N.	Clear	066	73,5	82,5	E.	Clear	022	72,6	83,8	75,0	b. n.	Clear	066	72,9	77,8	72,8	b. n.	Clear	039	72,0	78,2	73,0	Calm.	Clear
5	062	74,5	83,2	75,0	103,9	w. b. n.	Clear	066	73,5	82,5	E.	Clear	022	71,6	77,2	69,9	N.	Clear	066	72,9	77,8	72,8	Calm.	Clear	039	72,0	78,2	73,0	Calm.	Clear
6	0,60	72,5	84,5	75,2	103,5	N.	Clear	066	73,5	82,5	E.	Clear	022	71,6	77,2	69,9	N.	Clear	066	72,9	77,8	72,8	Calm.	Clear	039	72,0	78,2	73,0	Calm.	Clear
7	0,42	71,9	83,6	75,0	103,5	N.	Clear	066	74,1	79,5	E.	Clear	022	71,6	77,2	69,9	N.	Clear	066	72,9	77,8	72,8	Calm.	Clear	039	72,0	78,2	73,0	Calm.	Clear
8	0,11	73,0	80,2	73,8	102,5	N.	Clear	066	74,1	79,5	E.	Clear	022	71,6	77,2	69,9	N.	Clear	066	72,9	77,8	72,8	Calm.	Clear	039	72,0	78,2	73,0	Calm.	Clear
9	29,972	72,5	81,7	72,8	97,0	N.	Clear	066	74,1	79,5	E.	Clear	022	71,6	77,2	69,9	N.	Clear	066	72,9	77,8	72,8	Calm.	Clear	039	72,0	78,2	73,0	Calm.	Clear
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